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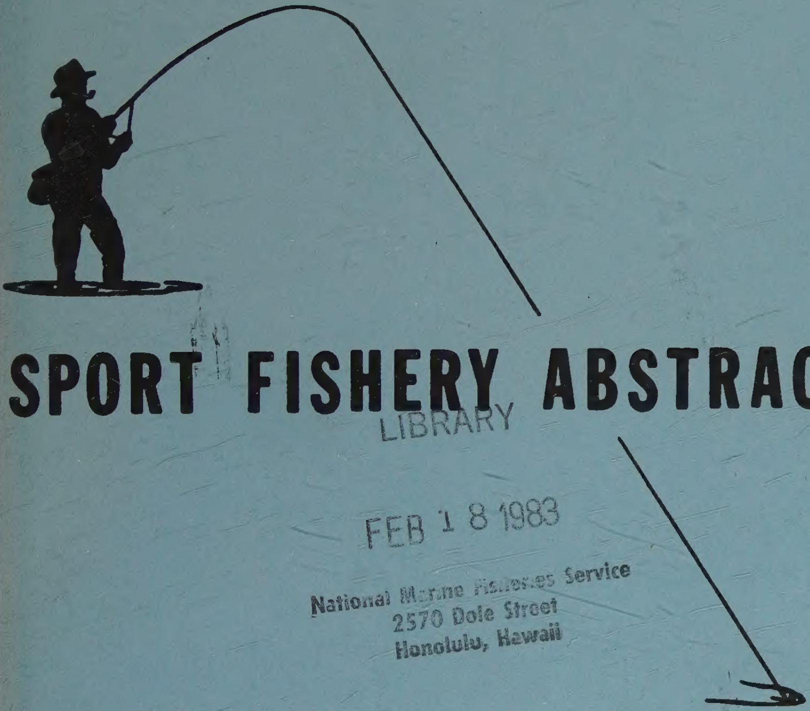

SPORT FISHERY ABSTRACTS

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SPORT FISHERY ABSTRACTS

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Terry N. Sexson, Assistant Editor

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Fort Collins, Colorado 80523

Sport Fishery Abstracts is intended to furnish fishery biologists with abstracts of current literature in sport fishery research and management.

One volume, consisting of four numbers, is issued each year. Each number contains separate Author, Geographic, and Taxonomic indexes, and the final number of each volume contains cumulative Author, Geographic, Taxonomic, and Subject indexes, and a list of publications screened. Authors who publish in journals not screened for *Sport Fishery Abstracts*, and who would like their publications included, should submit abstracts to the Editor.

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Volume 27 Number 4 1982

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AQUATIC PLANTS AND THEIR CONTROL

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[Sch. For. Resour. Conserv., Univ. Fla., Gainesville 32611] The Lake Conway model predicts that stocking white amur will decrease lake productivity and respiration, increase epipelic algae biomass for two years, and increase biomass of benthic invertebrates and biomass and number of secondary predator fish for at least nine years. Water quality, as defined by submersed macrophyte abundance, phytoplankton biomass, orthophosphate in the epilimnion, and amount of dead particulate organic matter in the water column, increases during the 10-y simulation. Because of the nature of white amur growth and assimilation rates, simulated grazing impact is heaviest three years after stocking. Carbon flow through both grazing and detritus food chains increases in the simulation, in spite of decreased photosynthesis.

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[Ecole Prat. Hautes Etudes, Stn. Mar. d'Endoume, F. 13007 Marseille, France]

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[Lab. Res. Fish Dis., Nir-David 19150, Israel]

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82-002057 Papst, M. H. and G. E. Hopky. GROWTH OF RAINBOW TROUT (*SALMO GAIRDNERI* RICHARDSON) IN A PILOT COMMERCIAL REARING SYSTEM. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 1112. iv + 18p. Aug. 1982. In English with French summ. SFA 27(4)
[Dep. Fish. Oceans, Winnipeg, MB R3T 2N6, Canada]

82-002058 Penczak, T.; W. Galicka; M. Molinski; E. Kusto and M. Zalewski. THE ENRICHMENT OF A MESOTROPHIC LAKE BY CARBON, PHOSPHORUS AND NITROGEN FROM THE CAGE AQUACULTURE OF RAINBOW TROUT, *SALMO GAIRDNERI*. *J. Appl. Ecol.* 19(2):371-393. Aug. 1982. SFA 27(4)
[Inst. Environ. Biol., Univ. Lodz, Banacha 12/16, 90-237 Lodz, Poland]
The cage aquaculture of rainbow trout, *Salmo gairdneri* Richardson, enriched the mesotrophic Glebokie Lake with carbon, phosphorus and nitrogen. Two generations were studied, from their introduction to the cages as 0 group trout in June untiltheir removal as marketable trout in the Autumn of the following year. An inter-generation budget of energy and bioelements (C,P,N) showed that, for every kilogram of marketable trout produced, the lake was enriched by 0.75kg C, 0.023kg P and 0.10kg N (27.91, 0.84 and 3.58 g $m^{-2}yr^{-1}$ respectively). This eutrophication is expected to cause the loss of the natural populations of Coregonidae. The values of K_1, K_2 and U^{-1} showed that harvesting trout in Summer and Autumn does not make full use of the high utilization of food during those periods; it is suggested that harvesting should occur in October and November.

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[Cape Dep. Nat. Environ. Conserv., P.B. 1006, Grahamstown 6140, South Africa]

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[Dep. Fish. Allied Aquacult., Agric. Exp. Stn., Auburn Univ., AL 36849]

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A preliminary experiment on the culture of *Sillago sihama* (Forskal) in a pond adjoining Netravathi estuary at Mangalore revealed a good prospect of farming this fish along the estuarine areas. The fish grows incredibly fast and attains marketable size in 3-4 months.

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[Kainji Lake Res. Inst., New Bussa, Nigeria]

82-002065 Kaliyamurthy, N.; G. Ramamohana Rao and A. V. Prabhakara Rao. ECOLOGICAL CONSIDERATIONS CONCERNING THE SEED OF CULTIVABLE FISHES OF THE PULICAT LAKE. *Indian J. Fish.* 24(1-2):223-227. 1977. SFA 27(4)

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[Dep. Zool., Fac. Sci., Univ. Lisbon, 1200 Lisbon, Portugal] The main types of body deformation found in sea bass, *Dicentrarchus labrax* (L), reared at the Centre Océanologique de Bretagne, from hatching to 100 days, are described and classified. Frequency of occurrence of each type of abnormality was followed in different batches of reared fishes. Results suggest that the majority of the abnormalities which appear in larval fish are lethal (from 0 to 40 days), while those which become apparent only in the post-larval fish (after 40 days) do not interfere with survival.

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[Sea Res. Found., Inst. Aquarium Stud., P.O. Box 7-495, West Hartford, CT 06107]

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[Trop. Products Inst., 56/62 Gray's Inn Rd., London WC1X 8LU, England]

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[Inst. Ichthyobiol. Fish., Acad. Agric. Technol., 10-957 Olsztyn-Kortowo, Poland]

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[Kagoshima Pref. Fish. Exp. Stn., 11-40 Kinko, Kagoshima 892, Japan]

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[Farm Fresh Catfish, Inc., Hollandale, MS 39762]

82-002083 Furuichi, M. and Y. Yone. AVAILABILITY OF CARBOHYDRATE IN NUTRITION OF CARP AND RED SEA BREAM. *Bull. Jpn. Soc. Sci. Fish.* 48(7):945-948. July 1982. SFA 27(4)
[Fish. Res. Lab., Kyushu Univ., Tsuyazaki, Fukuoka 811-333, Japan]

82-002084 Hecht, T. INTENSIVE REARING OF *CLARIAS GARIEPINUS* LARVAE (CLARIIDAE: PISCES). *S. Afr. J. Wildl. Res.* 12(3):101-105. 1982. In English with Afrikaans summ. SFA 27(4)
[Dep. Ichthyol. Fish. Sci., Rhodes Univ., Grahamstown 6140, South Africa]
Clarias gariepinus larvae were reared intensively at a density of 300 per litre on five experimental diets. The two most suitable diets were plankton and torula yeast and fishmeal and torula yeast, mixed on an equal basis. There was no statistical difference at the 99% confidence level between the growth rates of the larvae fed on these two diets. Methods and techniques are recommended regarding the commercial primary nursing of sharptooth catfish larvae and the cost of primary nursing is discussed. It is further recommended that fry only be stocked into nursery ponds after having attained a total length of 25mm in the hatchery.

82-002085 Higgs, D. A.; J. R. McBride; J. R. Markert; B. S. Dosanjh; M. D. Plotnikoff and W. C. Clarke. EVALUATION OF TOWER AND CANDLE RAPESEED (CANOLA) MEAL AND BRONOWSKI RAPESEED PROTEIN CONCENTRATE AS PROTEIN SUPPLEMENTS IN PRACTICAL DRY DIETS FOR JUVENILE CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*). *Aquaculture* 29(1-2):1-31. Aug. 1982. SFA 27(4)
[Dep. Fish. Oceans, West Vancouver Lab., 4160 Marine Dr., West Vancouver, BC V7V 1N6, Canada]

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[Dep. Nutr., Coll. Biol. Sci., Univ. Guelph, Guelph, ON N1G 2W1, Canada]

82-002087 Hughes, S. G. THE REQUIREMENT OF LAKE TROUT (*SALVELINUS NAMAYCUSH*) FOR DIETARY BRANCHED-CHAIN AMINO ACIDS. *Ph.D. dissertation, Cornell Univ.* 103p. 1982. From Diss. Abstr. Inst. B Sci. Eng. 43(4):922. Oct. 1982. SFA 27(4)

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[Scott. Mar. Biol. Assoc., P.O. Box 3, Oban, Argyll, Scotland]

82-002090 Kellems, R. O. and R. O. Sinnhuber. PERFORMANCE OF RAINBOW TROUT FED GELATIN-BOUND DIETS OF FISH PROTEIN CONCENTRATE OF CASEIN CONTAINING 25 TO 45 PERCENT HERRING OIL. *Prog. Fish-Cult.* 44(3):131-134. July 1982. SFA 27(4)
[Oreg. State Univ., Corvallis 97331]

82-002091 Klein-Macphee, G.; W. H. Howell and A. D. Beck. COMPARISON OF A REFERENCE STRAIN AND FOUR GEOGRAPHICAL STRAINS OF *ARTEMIA* AS FOOD FOR WINTER FLOUNDER (*PSEUDOPLEURONECTES AMERICANUS*) LARVAE. *Aquaculture* 29(3-4):279-288. Sept. 1982. SFA 27(4)
[Dep. Food Sci. Technol., Univ. R. I., Kingston 02881]

82-002092 Leatherland, J. F. EFFECT OF A COMMERCIAL TROUT DIET ON LIVER ULTRASTRUCTURE OF FED AND FASTED YEARLING COHO SALMON, *ONCORHYNCHUS KISUTCH* WALBAUM. *J. Fish Biol.* 21(3):311-319. Sept. 1982. SFA 27(4)
[Dep. Zool., Coll. Biol. Sci., Univ. Guelph, Guelph, ON, Canada]

82-002093 Messamer, R. K.; D. O. Terry; P. R. Worst; L. McDonald and G. M. Lindsdau. A MOBILE MECHANICAL FEEDING SYSTEM FOR LARGE LOTS OF FISH. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:86-90. 1982. Available @$10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)
[Wyo. Game Fish Dep., Clark's Fork Hatchery, Powell 82435] A useful and efficient mobile mechanical feeding system, consisting of a hopper and blower arrangement mounted on a four wheel drive all-terrain vehicle, has been utilized for the past eleven years at the Clark's Fork Hatchery in Wyoming. Experience has proven this device to be labor-saving, efficient, and economical. The time required to complete a feeding period is approximately one-third the time required with conventional hand-feeding. The

FEEDS, FEEDING, AND NUTRITION (CONTINUED)

82-002093 CONTINUED system allows one operator to deliver even amounts of feed to each raceway of fish in a minimum of time. Cost of operation and maintenance is also minimal. Fuel costs average $13.00 per month, and total maintenance costs over an eleven-year period from 1971 to the present were approximately $1,020.00. The average annual cost of this feeding system is $565.00.

82-002094 Murai, T.; T. Akiyama and T. Nose. EFFECTS OF CASEIN COATING ON UTILIZATION OF DIETARY AMINO ACIDS BY FINGERLING CARP AND CHANNEL CATFISH. *Bull. Jpn. Soc. Sci. Fish.* 48(6):787-792. June 1982. SFA 27(4)
[Div. Fish. Nutr., Natl. Res. Inst. Aquacult., Hiruta, Tamaki, Watarai, Mie 519-04, Japan]

82-002095 Okamoto, M. [STUDIES ON THE COMMUNITY ECOLOGY OF FISHES NEAR THE EXPERIMENTAL FISH NURSERY OF *PAGRUS MAJOR* USING ACOUSTIC CONDITIONING.] *Bull. Jpn. Soc. Sci. Fish.* 48(8):1113-1119. Aug. 1982. In Japanese with English summ. SFA 27(4)
[Jpn. Mar. Sci. Technol. Cent., Natsushima, Yokosuka 237, Japan] Experimental fish nursery of *Pagrus major* using acoustic conditioning had been constructed by Ohita Prefectural Fisheries Experimental Station. Young of *Pagrus major* were conditioned to feed immediately when the sound started in the feeding net cage, then they were released in Yonozu bay. In the bay, they were fed by an automatic feeder (feeding buoy) subsequently. After seven months, the behavioral characters and community ecology of fishes around the feeder were investigated by direct observation and by some automatic recording instruments. As results, some phenomena concerning the behavior of fishes were found as follows. (1) Around the feeder, fifty-seven kinds of fishes were found and the dominants were *Navodon modestus*, *Parapristipoma trilineatum* and *Pagrus major*. (2) In the daytime, *Navodon modestus* aggregated beneath the feeder or near the artifical reefs, and when artificial diet was scattered by the feeder, they clustered beneath the feeder and fed actively. In the nighttime, they rested at the bottom near the artificial reefs. (3) *Parapristipoma trilineatum* aggregated around the rocks near the feeder in the daytime, and fed the diet in the nightime. (4) *Pagrus major* (16-17 cm in total length) came near the feeder only in the daytime and fed at the bottom. (5) It seemed that most of the diet scattered from the feeder was fed on by these three species of fishes, and it was calculated that *Pagrus major* fed on about 20 percent of all diet scattered.

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MORPHOLOGY (CONTINUED)

82-002165 CONTINUED fins by 7.0 mm. Ossification had commenced by 5.5 mm and all bones, except the ethmoid and prevomer, had at least begun to ossify by 21.9 mm. Illustrations of snook larvae, including details of the caudal skeleton, are presented to show changes that occurred during development. Limited comparisons with field-caught snook are also presented.

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Eggs were artificially fertilized and incubated in seawater of various salinities and temperatures. Both the ultrastructure of the exceptionally large eggs (average diameter: 2.92 mm) and the embryonic development suggest that the early developmental stages of the halibut are pelagic. Light and electron microscope studies of the halibut eggs showed a thin, homogeneous, lamellated chorion with small pores on the outer surface. However, neutral buoyancy determinations indicated that eggs would float only in salinities greater than c. 37^{o}/oo. The halibut embryo, which develops very slowly, hatches at an apparently premature stage.

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[NMFS, 75 Virginia Beach Dr., Miami, FL 33149] Character displacement in animals, particularly in fishes, is reviewed and the new approach of Grant (1975) is used in this study to demonstrate character displacement in *P. hispaniolana* and *P. dominicensis*, two closely related and partly sympatric species of mollies endemic to Hispaniola. Background information is given on the probable origin, evolution, attainment of present partial sympatry and length of coexistence of the two species, as indicated by their present distribution and the paleogeography of Hispaniola. It is hypothesized that a common ancestor to both species existed on the island prior to the Miocene about 20 million years ago. It is also hypothesized that the ancestral population was split during the Miocene-Pliocene for a period of about 18 million years, that the two species evolved during that time, and that the barrier to their dispersal was eliminated in late Pliocene about two million years ago. It is assumed that during that last period the present distribution and partial sympatry were attained, and that the two species

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82-002188 CONTINUED have coexisted twice as long in the localities where character displacement shows greater magnitude. Analyses of meristics, morphometrics, and reproduction are given to demonstrate character displacement in fin ray, scale, and gill-raker number, and in body size and fecundity. Divergent, convergent, and parallel displacement were found to occur as well as a change of reproductive strategy for *P. dominicensis* in sympatry. Causes and effects of displacement in the two species are discussed and later summarized in combination with tentative conclusions.

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[Biol. Fac., Moscow Univ., USSR] An ecological and morphological analysis of the embryonic, larval and fingerling periods of development of the minnow, *Phoxinus phoxinus*, was carried out. The eggs are mesoplasmic, the mean diameter of mature oocytes is 1.13 mm. The embryonic period, including 9 stanzas, continued for about 11 days at a water temperature of 15-16°, hatching of the prolarvae occurs at an age of 4 days. The larval period of development includes 5 stanzas with a duration of about 1.5 months. On reaching a length of 17-20 mm the young passes into the fingerling period of development. Data are presented and discussed on the ecology of the young minnow, the peculiarities of its reaction to light, schooling, behavior, etc. The spawning livery of the minnow is described and the spawning times given.

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[Lab. Comp. Biochem., San Diego, CA 92109] As part of a survey of the red cell hematology of birds, reptiles and fishes, two dogfish sharks, the spiny, *Squalus acanthias* (suborder *Squaloidei*) and the smooth, *Mustelus canis* (suborder *Galeoidei*), have been selected from the elasmobranch fishes for a detailed study. Investigations were carried out on embryos, new born, young and adults at the Marine Biological Laboratory, Woods Hole, Mass. Studies on the changes of the red cell during early development of the two sharks, which have different modes of reproduction, the spiny ovoviviparous and the smooth viviparous, were facilitated by the ready availability of embryos of convenient size for sampling of blood and testing of the red cells. Phosphate components of the red cells were isolated by ion-exchange column chromatography and the turnover rates of the nucleotides measured by their incorporation of radioactivity after brief incubation with ^{32}P-labelled inorganic phosphate. Of special interest to a comparison of the two dogfishes is the concentration of red cell guanosine triphosphate which is high in the smooth and low in the spiny.

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[A.D. Pickering: Freshwater Biol. Assoc., Ferry House, Far Sawrey, North Ambleside, Cumbria, England]

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[Dep. Rehab. Med., Coll. Physician Surgeon, Columbia Univ., New York, NY] Behaviorial and physiological measurements were made during the winter at low temperatures to evaluate cold temperature dormancy in the brown bullhead. At 17°C and when slowly cooled to 3°C the bullheads often buried themselves in the mud. Animals buried at 3°C were not immobilized and would emerge

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82-002243 CONTINUED from the mud following a disturbance. No readjustment of the thermoregulatory mechanisms was seen when acclimatized bullheads were placed in a thermal gradient that was slowly cooled. At the end of 6-7 h, the bullheads always became quiescent in the warmest portion of the gradient available (11-13°C). Spontaneous activity and oxygen uptake were measured, at the acclimation temperature, for animals acclimated to 3-17°C at 2°C intervals. Spontaneous activity in an annular tank showed a high degree of compensation between 5 and 17°C. At 3°C the bullheads showed much less spontaneous activity and an exceptionally low initial hyperactive period following placement in the tank. When oxygen uptake was measured with a closed system technique which involved a very slight disturbance, large increases in magnitude and variability of oxygen uptake occurred at higher acclimation temperatures. These large increases were not seen if oxygen uptake of sleeping fish was measured with an open system. Overwintering in this species may simply involve an increase in the time spent burrowed in the mud asleep.

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[Res. Unit Comp. Anim. Respir., Univ. Bristol, Woodland Rd., Bristol BS8 1UG, U.K.] The standard oxygen consumption of flounders, *Platichthys flesus*, adapted for two months to 5 and 15°C was measured during single step and fluctuating temperature changes. A considerable recovery period from handling was required before standard levels were recorded, although no locomotor activity was evident. The Q_{10} (adapt) value between 5 and 15°C was 2.0. Q_{10} (acute) values were higher. The responses of oxygen consumption to temperature rise conform to Type III metabolic compensation (Precht, 1958). No compensatory response was evident at lower temperatures. An alternative explanation of the results in terms of excitement metabolism is suggested.

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[Dep. Biol., Univ. Oreg., Eugene] Social regulation of developmental rate of the African cichlid fish, *Haplochromis burtoni*, was studied experimentally. Broods were raised under three different social conditions: total isolation, with no visual, physical or chemical contact with siblings; physical isolation, with no physical or chemical contact with siblings; and in social groups. Development of behavior and color patterns were observed in fish from 2 to 14 weeks of age. Males were sacrificed at 4-week intervals to measure growth and maturation state. Results showed that developmental rate is influenced by the social environment. Males with no territories (raised in groups) grew and matured more slowly than those in all other conditions. These males were not prevented from maturing but both the rate and phenotypic expression of maturation were inhibited.

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[NMFS, Beaufort Lab., Beaufort, NC 28516] In larval spot, *Leiostomus xanthurus* Lacépède, ^{14}C labeled food was rapidly digested and assimilated with up to 20% respired as $^{14}CO_2$ within 10 h from ingestion. Two indices of carbon assimilation, total carbon utilization (range 9.4 to 64.7%) and total carbon absorption (range 67.2 to 99.2%) were calculated from the amount of ^{14}C ingested, retained, and defecated. Carbon utilization and absorption were not significantly ($P>0.10$) related to development as measured by age (7 to 47 days from hatching), length (1.8 to 11.4 mm), or dry weight (0.022 to 4.425 mg).

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GENETICS, VARIATION STUDIES AND HYBRIDIZATION (CONTINUED)

82-002381 CONTINUED systems or transferring to other hatcheries. Individual phenotypic characters were correlated with characters of the stream systems. Results of two agglomerative cluster analyses, one of certain characters of the stocks and one of certain characters of the stream systems, demonstrated a lack of correspondence between stream types and stock phenotypes between stream types and stock phenotypes.

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[Lab. Limnol., Univ. Wis., Madison 53706]

82-002395 Egglishaw, H. J. and P. E. Shackley. INFLUENCE OF WATER DEPTH ON DISPERSION OF JUVENILE SALMONIDS, *SALMO SALAR* L. AND *S. TRUTTA* L., IN A SCOTTISH STREAM. *J. Fish Biol.* 21(2):141-155. Aug. 1982. SFA 27(4)
[Freshwater Fish. Lab., Pitlochry, Perthshire, Scotland] The dispersion of salmon and trout of 0+, 1+ and 2+ age classes was examined by electrofishing 12 sections of a stream in Perthshire, Scotland at the end of the growing

BEHAVIOR (CONTINUED)

82-002395 CONTINUED season in September to October in 1972 and 1976. In 1972 sections ranged in surface area from 21 to 122m^2 and had volumes of 5.0-17.3m^3 and when surveyed in 1976 surface areas were 15-106 m^2 and volumes 2.1-6.7m^3. In 1976 widths and areas of sections were 63-87% of the values for 1972, depths were 39-68% and volumes 28-52% of the earlier values. These differences were due to 1976 being drier and warmer. In both years, all sections contained 0+ and 1+ age classes of salmon and trout and some sections contained 2+ age salmon and trout. The total density of fish in a section ranged from 1.9 to 3.9m^{-2} in 1972 and from 3.72 to 6.08m^{-2} in 1976. There was an inverse relationship, significant in 1972 only, between the density of 0+ salmon and that of 1+ trout in the different sections. Densities of both 0+ and 1+ salmon in the sections were inversely correlated, and those of 0+ and 1+ trout were directly correlated, with area of water deeper than 10cm.

82-002396 Fay, R. R. and B. Passow. TEMPORAL DISCRIMINATION IN THE GOLDFISH. *J. Acoust. Soc. Am.* 72(3):753-760. Sept. 1982. SFA 27(4)
[Parmly Hear. Inst., Loyola Univ. Chicago, 6525 N. Sheridan Rd., Chicago, IL 60626]

82-002397 Finger, T. R. INTERACTIVE SEGREGATION AMONG THREE SPECIES OF SCULPINS *(COTTUS)*. *Copeia* 1982(3):680-694. 10 Aug. 1982. SFA 27(4)
[Sch. For. Fish. Wildl., 112 Stephens Hall, Univ. Mo., Columbia 65211]

82-002398 Gibson, R. N. THE EFFECT OF HYDROSTATIC PRESSURE CYCLES ON THE ACTIVITY OF YOUNG PLAICE *PLEURONECTES PLATESSA*. *J. Mar. Biol. Assoc. U.K.* 62(3):621-635. Aug. 1982. SFA 27(4)
[Scott. Mar. Biol. Assoc., Dunstaffnage Mar. Res. Lab., P.O. Box 3, Oban, Argyll, Scotland PA34 4AD] Young plaice of 5-8 cm in length were subjected to sinusoidal hydrostatic pressure cycles varying in amplitude and period from 0.16 to 1.5 m and 2 to 12.6 h. The response to the pressure cycle was assessed by χ^2 periodogram analysis of the changes in locomotory activity throughout the cycle. A low response rate was recorded, but some fish responded to pressure changes of 0.25-1.5 m amplitude. The amplitude of the pressure change was found to be more important than the rate in eliciting the response.

82-002399 Heller, J. AGGRESSION COLOUR PATTERN OF *ASTATOTILAPIA FLAVIIJOSEPHI* (TELEOSTEI: CICHLIDAE) IN THE AQUARIUM. *Isr. J. Zool.* 30(1-2):88-91. 1981. SFA 27(4)
[Dep. Zool., Hebrew Univ. Jerusalem, Jerusalem 91904, Israel]

82-002400 Johnson, J. H. and E. Z. Johnson. OBSERVATIONS ON THE EYE-PICKING BEHAVIOR OF THE CUTLIPS MINNOW, *EXOGLOSSUM MAXILLINGUA*. *Copeia* 1982(3):711-712. 10 Aug. 1982. SFA 27(4)
[N.Y. Dep. Environ. Conserv., 50 Wolf Rd., Albany 12233]

82-002401 Johnson, W. S. and V. C. Chase. A RECORD OF CLEANING SYMBIOSIS INVOLVING *GOBIOSOMA* SP. AND A LARGE CARIBBEAN OCTOPUS. *Copeia* 1982(3):712-714. 10 Aug. 1982. SFA 27(4)
[Dep. Biol. Sci., Goucher Coll., Towson, MD 21204]

82-002402 Klimov, V. I. and G. I. Ogurtsov. PECULIARITIES OF BEHAVIOR IN HATCHERY PRODUCED CARP LARVAE, *CYPRINUS CARPIO*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(4):147-149. 1981. SFA 27(4)
[VNIIPRKh, Rybnoye, USSR]

BEHAVIOR (CONTINUED)

82-002403 Kruchinin, O. N.; Y. A. Kuznetsov and M. A. Sorokin. THE DIURNAL RHYTHM IN THE ACTIVITY OF SOME FAR EASTERN SPECIES OF FISH. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(1):127-134. 1981. SFA 27(4)
[TINRO, Vladivostock, USSR]

82-002404 Loekle, D. M.; D. M. Madison and J. J. Christian. TIME DEPENDENCY AND KIN RECOGNITION OF CANNIBALISTIC BEHAVIOR AMONG POECILIID FISHES. *Behav. Neural Biol.* 35(3):315-318. July 1982. SFA 27(4)
[Dep. Biol. Sci., State Univ. N.Y., Binghamton 13901]

82-002405 Mackie, A. M. and A. I. Mitchell. FURTHER STUDIES ON THE CHEMICAL CONTROL OF FEEDING BEHAVIOUR IN THE DOVER SOLE, *SOLEA SOLEA*. *Comp. Biochem. Physiol. A Comp. Physiol.* 73(1):89-93. 1982. SFA 27(4)
[Nat. Environ. Res. Counc., Inst. Mar. Biochem., Aberdeen AB1 3RA, Scotland] The feeding stimulant requirement of the Dover sole was very specific, only betaine and dimethylthetin being effective. Substances tasting bitter to the human tongue acted as feeding deterrents for the sole. Of the other feeding deterrents identified, anthraquinone pigments, azo dyes and saponins were the most potent. The results are discussed in the context of both aquaculture and chemical ecology.

82-002406 Malyukina, G. A. and V. I. Martem'yanov. AN ELECTROCARDIOGRAPHIC STUDY OF CHEMICAL SENSITIVITY IN SOME FRESHWATER FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(3):77-84. 1981. SFA 27(4)
[Biol. Fac., Moscow Univ., USSR]

82-002407 Minami, T. [THE EARLY LIFE HISTORY OF A TONGUE FISH *PARAPLAGUSIA JAPONICA*.] *Bull. Jpn. Soc. Sci. Fish.* 48(8):1041-1046. Aug. 1982. In Japanese with English summ. SFA 27(4)
[Dep. Fish., Fac. Agric., Kyoto Univ., Kyoto 606, Japan]

82-002408 Mizuno, N.; M. Mukai; A. Goto and K. Hamada. [STUDIES ON THE FRESHWATER FISH IN HOKKAIDO, JAPAN-II. DISTRIBUTION OF TWO TYPES OF A GOBY, *RHINOGOBIUS BRUNNEUS*.] *Bull. Fac. Fish. Hokkadio Univ.* 33(3):115-125. Sept. 1982. In Japanese with English summ. SFA 27(4)
[Lab. Embryol. Genet., Fac. Fish., Hokkaido Univ., Hakodate, Japan]

82-002409 Nashimoto, K.; K. Ishii; S. Sasaki and T. Meguro. [THE SWIMMING SPEED OF TUNAS IN RELATION TO TAIL BEAT FREQUENCY.] *Bull. Jpn. Soc. Sci. Fish.* 48(7):933-939. July 1982. In Japanese with English summ. SFA 27(4)
[Fac. Fish., Hokkaido Univ., Minato, Hokodate 041, Japan]

82-002410 Neil, S. J. THE AGONISTIC BEHAVIOR OF *CICHLASOMA MEEKI* (PISCES: CICHLIDAE): A TEST OF GAME THEORETIC PREDICTIONS. *Ph.D. dissertation, Univ. Minn.* 156p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(1):36. July 1982. SFA 27(4)

82-002411 Reynolds, W. W.; M. E. Casterlin and D. G. Lindquist. THERMAL PREFERENDA AND DIEL ACTIVITY PATTERNS OF FISHES FROM LAKE WACCAMAW. *Brimleyana* No. 7. p. 55-60. July 1982. SFA 27(4)
[D. G. Lindquist: Dep. Biol., Univ. N.C., Wilmington, NC 28406] We tested seven fish species from Lake Waccamaw in Ichthyotron electronic shuttleboxes to determine their preferred temperatures and diel activity patterns. All preferred temperatures between 25° and 31°C, which corresponded to water temperatures measured in the lake in August 1981. All species avoided temperatures below 20° or above 36°C. One species was diurnal, two were

BEHAVIOR (CONTINUED)

82-002411 CONTINUED nocturnal, and four were crepuscular in diel activity pattern under the LD 14:10 August photoperiod.

82-002412 Saglio, P.; M. Le Martret. COMMUNICATION INTRASPÉCIFIQUE D'ORIGINE PHÉROMONALE CHEZ E CARASSIN DORÉ IMMATURE (*CARASSIUS AURATUS* L.). II. ETUDE EN OLFACTIOMÈTRE DE L'ACTIVITÉ COMPORTEMENTALE D'EXTRAITS D'ORIGINE EPIDERMIQUE. [THE ROLE OF PHEROMONES IN INTRASPECIFIC COMMUNICATION IN IMMATURE GOLDFISH, *CARASSIUS AURATUS* L. II. OLFACTOMETRIC STUDY OF THE BEHAVIORAL ACTIVITY OF EPIDERMIC EXTRACTS.] *Biol. Behav.* 7(3):221-234. 1982. In French with English summ. SFA 27(4)
[Lab. Ecol. Poissons Amenage. Peches, I.N.R.A., B.P. N°3, Saint-Pee-sur-Nivelle, F 64310 Ascain, France]

82-002413 Savchenko, N. V.; A. G. Gusar and V. A. Getmantsev. THE LOCOMOTOR ACTIVITY OF FISHES IN LOW ILLUMINATION. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(1):171-175. 1981. SFA 27(4)
[VNIRO, Moscow, USSR]

82-002414 Sbikin, Y. N. THE OPTOMOTOR REACTION AND SOME CHARACTERISTICS OF THE VISION OF YOUNG STURGEON. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(1):167-171. 1981. SFA 27(4)
[IEMEZh, USSR Acad. Sci., Moscow, USSR]

82-002415 Scott, J. S. SELECTION OF BOTTOM TYPE BY GROUNDFISHES OF THE SCOTIAN SHELF. *Can. J. Fish. Aquatic Sci.* 39(7):943-947. July 1982. In English with French summ. SFA 27(4)
[Mar. Fish Div., Dep. Fish. Oceans, Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

82-002416 Smith, J. W. and J. V. Merriner. ASSOCIATION OF COBIA, *RACHYCENTRON CANADUM, WITH COWNOSE RAY, RHINOPTERA BONASUS. Estuaries* 5(3):240-242. Sept. 1982. SFA 27(4)
[S.C. Wildl. Mar. Resour. Dep., P.O. Box 12559, Charleston 29412]

82-002417 Squire, J. L., Jr. CATCH TEMPERATURES OF SOME IMPORTANT MARINE SPECIES OFF CALIFORNIA. *NOAA Tech. Rep. NMFS SSRF* 759. iii + 17p. Aug. 1982. SFA 27(4)
[NMFS, P.O. Box 271, La Jolla, CA 92038]

82-002418 Uematsu, K. and K. Yamamori. BODY VIBRATION AS A TIMING CUE FOR SPAWNING IN CHUM SALMON. *Comp. Biochem. Physiol. A Comp. Physiol.* 72(3):591-594. 1982. SFA 27(4)
[Fac. Appl. Biol. Sci., Hiroshima Univ., Fukuyama, Hiroshima 720, Japan]
Trunk muscular EMG in both sexes of spawning chum salmon were recorded simulataneously with the aid of a telemetry system in order to determine the sex which initiates spawning. The trunk muscular activities for spawning in both sexes consisted of two stages i.e. an initial weak and a final strong burst. During the final stage, oviposition and sperm ejaculation occurred. The initial stage in the female began prior to that in the male, while the final stage in the male occurred before the female's. The possible significance of the amplitude change in the spawning convulsion as a signal for synchronizing the spawning of both sexes, was discussed.

BEHAVIOR (CONTINUED)

82-002419 Zerbolio, D. J., Jr. and J. L. Royalty. ACQUISITION AND EXTINCTION OF DIFFERENTIAL RESPONSES TO SIGNALS PAIRED WITH SHOCK OR SHOCK OMISSION IN GOLDFISH: EVIDENCE FOR TRULY DISCRIMINATED AVOIDANCE LEARNING. *Anim. Learn. Behav.* 10(3):377-389. Aug. 1982. SFA 27(4)
[Dep. Psychol., Univ. Mo., St. Louis 63121]

LIFE HISTORY-GENERAL WORKS

82-002420 Burr, B. M. and L. M. Page. THE LIFE HISTORY OF THE LEAST DARTER, *ETHEOSTOMA MICROPERCA*, IN THE IROQUOIS RIVER, ILLINOIS. *Ill. Nat. Hist. Surv. Biol. Notes* No. 112. 15p. Aug. 1979. SFA 27(4)
[Ill. Nat. Hist. Surv., Urbana]

82-002421 Craig, D. and G. J. FitzGerald. REPRODUCTIVE TACTICS OF FOUR SYMPATRIC STICKLEBACKS (GASTEROSTEIDAE). *Environ. Biol. Fishes* 7(4):369-375. 15 Sept. 1982. SFA 27(4)
[Dep. Biol., Fac. Sci. Génie, Univ. Laval, PQ G1K 7P4, Canada]

82-002422 Devadoss, P.; P. K. M. Pillai; P. Natarajan and K. Muniyandi. OBSERVATIONS ON SOME ASPECTS OF THE BIOLOGY AND FISHERY OF *PSETTODES ERUMEI* (BLOCH) AT PORTO NOVO. *Indian J. Fish.* 24(1-2):62-68. 1977. SFA 27(4)
Psettodes erumei is a carnivorous fish subsisting mainly on fishes (81.73%). Crustaceans (11.93%) and molluscs (6.34%) are also found in the stomach. The spawning season is observed to be a prolonged one extending over a period of nearly 7 months from November to May as against the short and restricted spawning of this species in west coast of India. The fishery is a minor one, estimated to contribute about 8.6 metric tons annually, forming 0.58% of the total marine fish catches in Porto Novo during 1971-1973. Seasonal abundance and fluctuations in the catches are also dealt with.

82-002423 Frederick, L. L. ECOLOGY OF JUVENILE WHITEFISH (*COREGONUS CLUPEAFORMIS*) IN LAKE MICHIGAN, EAST OF DOOR COUNTY, WISCONSIN. *Ph.D. dissertation, Univ. Wis.* 115p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(4):981. Oct. 1982. SFA 27(4)
The lake whitefish (*Coregonus clupeaformis*) is the major commercial species in Lake Michigan but little is known about its life history until it appears in the commercial catch at Age III. This study investigated larval and young-of-the-year life history parameters of lake whitefish from April, 1974, through October, 1976. Lake whitefish eggs were spawned in November and hatched the following April at ice out. Larvae were found in a series of shallow, protected bays along the Door County shore of Lake Michigan until mid-May. By early August, young-of-the-year whitefish had grown to 120 mm total length and were established as members of the benthic community in 10-30 m of water outside the bays. Their diet shifted from rotifers to larger zooplankton, and finally chironomids and *Pontoporeia*. A concurrent gil netting program assessed other fish species from the area occupied by juvenile whitefish to determine the potential for predation and competition. Population estimates indicate that whitefish year class strength is determined sometime between hatching and recruitment to the fishery at Age III. The 1975 larval catch was significantly smaller than the 1974 and 1976 larval catches. By August, there was no significant difference in young-of-the-year catch among years, and by Age III, the 1975 year class stood out as significantly larger. In 1975, larval whitefish in nursery bays were distributed independently of each other in 50 percent of the samples. In 1974 and 1976 larval whitefish were distributed in clusters. The tendency of larvae to cluster within the nursery area could affect their ability to attack sufficient quantities of food, particularly if both larval

LIFE HISTORY-GENERAL WORKS (CONTINUED)

82-002423 CONTINUED and plankton distributions are influenced by storm surges and seiches. Patchiness of distribution could also influence the opportunity for interaction with predators.

82-002424 Hindar, K. and B. Jonsson. HABITAT AND FOOD SEGREGATION OF DWARF AND NORMAL ARCTIC CHARR (*SALVELINUS ALPINUS*) FROM VANGSVATNET LAKE, WESTERN NORWAY. *Can. J. Fish. Aquatic Sci.* 39(7):1030-1045. July 1982. In English with French summ. SFA 27(4)
[Zool. Inst., Univ. Oslo, P.O. Box 1050 Blindern, Oslo 3, Norway]

82-002425 Hussain, N. A. and M. A. S. Abdullah. THE LENGTH-WEIGHT RELATIONSHIP, SPAWNING SEASON AND FOOD HABITS OF SIX COMMERCIAL FISHES IN KUWAITI WATERS. *Indian J. Fish.* 24(1-2):181-194. 1977. SFA 27(4)

82-002426 Kwain, W. SPAWNING BEHAVIOR AND EARLY LIFE HISTORY OF PINK SALMON (*ONCORHYNCHUS GORBUSCHA*) IN THE GREAT LAKES. *Can. J. Fish. Aquatic Sci.* 39(10):1353-1360. Oct. 1982. In English with French summ. SFA 27(4)
[Lake Superior Fish. Res. Unit, Fish. Br., Ontario Minist. Nat. Resour., Sault Ste. Marie, ON P6A 2B3, Canada]

82-002427 Magnan, P. and G. J. FitzGerald. RESOURCE PARTITIONING BETWEEN BROOK TROUT (*SALVELINUS FONTINALIS* MITCHELL) AND CREEK CHUB (*SEMOTILUS ATROMACULATUS* MITCHELL) IN SELECTED OLIGOTROPHIC LAKES OF SOUTHERN QUEBEC. *Can. J. Zool.* 60(7):1612-1617. July 1982. In English with French summ. SFA 27(4)
[Dep. Biol., Univ. Laval, PQ G1K 7P4, Canada] The spatial distribution, food habits, and growth of an allopatric brook trout (*Salvelinus fontinalis*) population was compared with a trout population coexisting with creek chub (*Semotilus atromaculatus*). Sympatric trout differed in spatial distribution and food habits from allopatric trout suggesting a niche shift of the trout when they live with creek chub. Also, although there is a certain overlap in diet and spatial distribution, sympatric populations of the two species differed on these resource axes. However, growth of sympatric trout is not clearly related to the presence or absence of the creek chub, suggesting that factors other than interspecific competition may affect growth in the seven study lakes.

82-002428 Manooch, C. S. III and C. A. Barans. DISTRIBUTION, ABUNDANCE, AND AGE AND GROWTH OF THE TOMTATE, *HAEMULON AUROLINEATUM*, ALONG THE SOUTHEASTERN UNITED STATES COAST. *NOAA Fish. Bull.* 80(1):1-19. Jan. 1982. SFA 27(4)
[NMFS, Beaufort, NC 28516] Tomtates, *Haemulon aurolineatum*, were widely distributed over sponge-coral habitats throughout the South Atlantic Bight region in depths of 9 to 55 m, although they were occasionally caught in large numbers over sandy bottom habitats. Fish were most common in offshore areas during winter and not taken in water of <10°C south of Cape Fear, N.J. Juveniles (≦148 mm TL) were caught in the same geographical areas as adults, but were collected in warmer waters than adults during fall and winter. Spawning occurred during the spring. Individuals collected by hook and line and trawl were aged by scales and otoliths. Back-calculated mean total lengths were from 103.0 mm at age I, to 280.5 at age IX. The von Bertalanffy growth equation is $l_t=310(1-\exp-0.22017(t+1.28))$, where t is age in years, and l_t is total length at age. The oldest fish sampled was age IX,289 mm TL. Annual total mortality based on catch curves from 1,496 fish landed by the recreational fishery from 1972 to

82-002428 CONTINUED 1978 was 59% (instantaneous total annual mortality = 0.89). We found that the tomtate grows faster, does not live as long, and has a higher natural mortality rate than most other reef fishes previously studied in the South Atlantic Bight.

82-002429 Markle, D. F.; D. A. Methven and L. J. Coates-Markle. ASPECTS OF SPATIAL AND TEMPORAL COOCCURRENCE IN THE LIFE HISTORY STAGES OF THE SIBLING HAKES, *UROPHYCIS CHUSS* (WALBAUM 1792) AND *UROPHYCIS TENUIS* (MITCHILL 1815) (PISCES: GADIDAE). *Can. J. Zool.* 60(9):2057-2078. Sept. 1982. In English with French summ. SFA 27(4)

[Huntsman Mar. Lab., St. Andrews, NB E0G 2X0, Canada] The amount of coexistence in the sympatric sibling species, *Urophycis chuss* and *U. tenuis*, appears to be a function of ontogeny, with each life history stage showing different probabilities of interspecific encounters. Demersal juveniles coexist the least since *U. chuss* is inquiline with scallops and *U. tenuis* is in nearshore shallows. In *U. tenuis* there is also intraspecific segregation, with older juveniles and young adults bathymetrically segregated from the youngest demersal juveniles in summer. Relatively more coexistence is seen between neustonic juveniles. However, they show some seasonal and pronounced diel differences in availabilty to neuston nets (*U. chuss* predominates during the day and *U. tenuis* during night). The greatest coexistence is seen between adult *U. chuss* and adolescent to adult *U. tenuis*. Over its life, *U. tenuis* tends to move into deeper water while *U. chuss* is relatively stenotopic, its distribution largely a reaction to temperature. This life history strategy of *U. tenuis* is "get big quick", a goal achieved, in part, through delayed maturation (relative to *U. chusss*). The strategy of *U. chuss* seems to be avoid predation, concentrate growth in the juvenile stage, and "get mature quick." We speculate that both species' life histories may be subordinate to getting the demersal juveniles into the right nursery area at the right time.

82-002430 Morin, R.; J. J. Dodson and G. Power. LIFE HISTORY VARIATIONS OF ANADROMOUS CISCO (*COREGONUS ARTEDII*), LAKE WHITEFISH (*C. CLUPEAFORMIS*), AND ROUND WHITEFISH (*PROSOPIUM CYLINDRACEUM*) POPULATIONS OF EASTERN JAMES-HUDSON BAY. *Can. J. Fish. Aquatic Sci.* 39(7):958-967. July 1982. In English with French summ. SFA 27(4)

[J. J. Dodson: GIROQ, Dep. Biol., Univ. Laval, Quebec City, PQ G1K 7P4, Canada]

82-002431 Nash, R. D. M. THE BIOLOGY OF FRIES' GOBY, *LESUEURIGOBIUS FRIESII* (MALM), IN THE FIRTH OF CLYDE, SCOTLAND, AND A COMPARISON WITH OTHER STOCKS. *J. Fish Biol.* 21(1):69-85. July 1982. SFA 27(4)

[Inst. Marinbiol. Liminol., Univ. Oslo, Postboks 1064, Blindern, Oslo 3, Norway] The general biology of a population of *Lesueurigobius friesii* in the Firth of Clyde, Scotland, was studied between October 1977 and December 1979. In this population the fish attained 95 mm and lived a maximum of nine years. The population growth characteristics from von Bertalanffy growth curves showed that the Clyde stock of *L. friesii* attained a greater maximum theoretical length ($L\infty$) than stocks in the Lynn of Lorne or Biscay and had a lower growth coeffcient (K). In all three stocks, the majority of the growth in length ($A_{0 \cdot 95}$) was achieved by the end of the fourth year of life. In general the sex ratio was 1:1 throughout the season. Spawning occurred from May to August, approximately the same time as the Lynn of Lorne stock. Sexual maturity was first reached at a smaller size in males than females. The abundance of *L. friesii* in the Clyde fluctuated considerably with reduced numbers of fish caught just after spawning.

LIFE HISTORY-GENERAL WORKS (CONTINUED)

82-002432 Nigro, A. A. and J. J. Ney. REPRODUCTION AND EARLY-LIFE ACCOMMODATIONS OF LANDLOCKED ALEWIVES TO A SOUTHERN RANGE EXTENSION. *Trans. Am. Fish. Soc.* 111(5):559-569. Sept. 1982. SFA 27(4)
[U.S. FWS, Natl. Fish. Res. Cent., Grand Coulee, WA 99163]

82-002433 Page, L. M. and R. L. Mayden. THE LIFE HISTORY OF THE TENNESSEE SNUBNOSE DARTER, *ETHEOSTOMA SIMOTERUM* IN BRUSH CREEK, TENNESSEE. *Ill. Nat. Hist. Surv. Biol. Notes* No. 117. 11p. Aug. 1981. SFA 27(4)
[Ill. Nat. Hist. Surv., Urbana]

82-002434 Page, L. M. THE LIFE HISTORIES OF *ETHEOSTOMA OLIVACEUM* AND *ETHEOSTOMA STRIATULUM*, TWO SPECIES OF DARTERS IN CENTRAL TENNESSEE. *Ill. Nat. Hist. Surv. Biol. Notes* No. 113. 14p. Aug. 1980. SFA 27(4)
[Ill. Nat. Hist. Surv., Urbana]

82-002435 Paine, M. D.; J. J. Dodson and G. Power. HABITAT AND FOOD RESOURCE PARTITIONING AMONG FOUR SPECIES OF DARTERS (PERCIDAE: *ETHEOSTOMA*) IN A SOUTHERN ONTARIO STREAM. *Can. J. Zool.* 60(7):1635-1641. July 1982. In English with French summ. SFA 27(4)
[G. Power: Dep. Biol., Univ. Waterloo, Waterloo, ON N2L 3G1, Canada] Resource partitioning among four species of darters (Percidae: *Etheostoma*) in an Ontario stream was investigated by determining diet and relative abundance in two habitats. The four species partitioned both food and habitat resources. *E. caeruleum* and *E. flabellare* dominated the riffles; the former took prey from rock surfaces, the latter took prey from between and beneath rocks. *Etheostoma microperca* and *E. nigrum* dominated the weed beds; the former feeding on prey on and around plants, the latter feeding on benthic prey. Diets were closely related to morphology, but habitat utilization was not. Determining the importance of habitat versus food partitioning is difficult, because microhabitat and foraging habitat may be nearly identical.

82-002436 Peterson, N. P. POPULATION CHARACTERISTICS OF JUVENILE COHO SALMON (*ONCORHYNCHUS KISUTCH*) OVERWINTERING IN RIVERINE PONDS. *Can. J. Fish. Aquatic Sci.* 39(9):1303-1307. Sept. 1982. In English with French summ. SFA 27(4)
[Wash. State Dep. Fish., Forks 98331]

82-002437 Pollock, B. R. SPAWNING PERIOD AND GROWTH OF YELLOWFIN BREAM, *ACANTHOPAGRUS AUSTRALIS* (GÜNTHER), IN MORETON BAY, AUSTRALIA. *J. Fish Biol.* 21(3):349-355. Sept. 1982. SFA 27(4)
[Fish. Res. Br., Dep. Primary Indus., Transport House, Fortitude Valley, Queensland, Australia] Monthly changes in the gonosomatic index indicate that yellowfin bream, *Acanthopagrus australis*, in Moreton Bay have a short spawning season with a peak during the period July to August each year. The growth rate of *A. australis* was estimated from tag-recapture data and by length-frequency analysis. Modes representing age classes 0, I and II often appeared in length-frequency distributions, however modes for older age classes were difficult to identify. The von Bertalanffy growth curve parameters calculated from release-recapture data are: L_∞ = 29.5cm; K=0.51; t_0=-0.32 years.

82-002438 Pratt, H. L., Jr. and R. B. Conklin. OBSERVATIONS ON LARGE WHITE SHARKS, *CARCHARODON CARCHARIAS*, OFF LONG ISLAND, NEW YORK. *NOAA Fish. Bull.* 80(1):153-156. Jan. 1982. SFA 27(4)
[NMFS, Narragansett, RI 02992]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

82-002439 Ramanathan, N.; P. Vijaya; V. Ramaiyan and R. Natarajan. ON THE BIOLOGY OF THE LARGE-SCALED TONGUE SOLE *CYNOGLOSSUS MACROLEPIDOTUS* (BLEEKER). *Indian J. Fish.* 24(1-2):83-89. 1977. SFA 27(4)
The biometry of *C. macrolepidotus* using the regression equation y = a+bx has been studied; the regression lines based on the angle of the tangent show that total length has the fastest growth and the eye diameter the slowest. The food of *C. macrolepidotus* consists of crustaceans, bivalves, polychaetes, fish larvae, phytoplankton and algal matter, of which the crustaceans appear to be highly favoured. Ova-diameter measurements show that spawning takes place from August to October (Pre-monsoon period). The fecundity of the fish, which increases with its size, shows a range of 25,663 to 317,577. The size of the female at first maturity is 191 mm.

82-002440 Randall, R. G. EMERGENCE, POPULATION DENSITIES, AND GROWTH OF SALMON AND TROUT FRY IN TWO NEW BRUNSWICK STREAMS. *Can. J. Zool.* 60(10):2239-2244. Oct. 1982. In English with French summ. SFA 27(4)
[Fish. Res. Br., Gulf Reg., P.O. Box 5030, Moncton, NB E1C 9B6, Canada] Postemergent downstream dispersal of Atlantic salmon fry (*Salmo salar*) was monitored using drift samplers during spring 1978 in two Miramichi River, N.B., tributaries. Catch rates of salmon fry peaked during the 2nd and 3rd weeks of June in both streams, coinciding with peak emergence of the salmon from the gravel. Very few trout fry (*Salvelinus fontinalis*) were captured in the drift nets, but electrofishing results indicated trout emergence preceded salmon by about 3 weeks. The earlier emergence of the trout gave them an early growth advantage over the salmon, so that trout fry were usually larger than salmon fry inhabiting the same stream areas. Early growth rates of both salmon and trout were quite varied among four stream sites during 2 years when growth was monitored; growth differences were discussed in relation to stream temperatures and density-dependent growth. Salmon fry were more abundant than trout fry at most sites in both years.

82-002441 Rohde, F. C. and R. G. Arndt. LIFE HISTORY OF A COASTAL PLAIN POPULATION OF THE MOTTLED SCULPIN, *COTTUS BAIRDI* (OSTEICHTHYES: COTTIDAE), IN DELAWARE. *Brimleyana* No. 7. p. 69-94. July 1982. SFA 27(4)
[Chas. T. Main, Inc., Prudential Cent., Boston, MA 02199] Aspects of the biology of a Coastal Plain population of *Cottus bairdi* in a lowland forest stream in Delaware were examined during 1973-81. *Cottus bairdi* occurs primarily over a gravel substrate; naturally-occurring rocks are absent. Individuals are shorter-lived and attain sexual maturity at a smaller size than in other studied populations. Two age groups, and a presumed third, were found. Only 33% of age group 0 survives to spawn in age group I. Spawning occurs in February and March at a water temperature of 6.6° to 12.5° C, and mean ovum diameter is 2.15 mm. There is a strong relationship between ova number and standard length ($Y = -157.11 + 6.80\ SL$). Fecundity is lower than that reported for most populations of *C. bairdi*. Most eggs are deposited in single-spawn clusters, with a mean egg number of 134.2 per cluster. Condition factor indicates that males are generally more robust than females. Most growth in length occurs in age group 0, males are longer than females, and there is a highly significant difference in sex ratio of mature specimens taken. Dominant food is trichopteran and dipteran larvae, and plecopteran nymphs; crustaceans, ephemeropteran nymphs, and coleopteran larvae are of minor importance. There is seasonal variation in food items. Diet differs only slightly as a function of sculpin size.

82-002442 Rozenvasser, Y. M. and Y. V. Mikodina. CHARACTERISTICS OF THE LONG-FINNED MULLET, *MUGIL AURATUS*, OVERWINTERING IN THE BLACK SEA AND MIGRATING IN SPRING INTO THE SEA OF AZOV. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(1):156-160. 1981. SFA 27(4)
[VNIRO, Moscow, USSR]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

82-002443 Samaritan, J. M. and R. E. Schmidt. ASPECTS OF THE LIFE HISTORY OF A FRESHWATER POPULATION OF THE MUMMICHOG, *FUNDULUS HETEROCLITUS* (PISCES: CYPRINODONTIDAE), IN THE BRONX RIVER, NEW YORK, U.S.A. *Hydrobiologia* 94(2):149-154. 3 Sept. 1982. SFA 27(4)
[Fordham Univ., Bronx, NY 10458]

82-002444 Schmidt, R. E. and M. McGurk. BIOLOGY OF THE EUROPEAN BITTERLING *RHODEUS SERICEUS* (PISCES: CYPRINIDAE) IN THE BRONX RIVER, NEW YORK, USA: AN APPARENTLY BENIGN EXOTIC SPECIES. *Biol. Conserv.* 24(2):157-162. Oct. 1982. SFA 27(4)
[R.D. No. 4, Box 208, Newton, NJ 07860] Selected aspects of the biology of European bitterling *Rhodeus sericeus* in southern New York were investigated as a preliminary determination of the impact of this species on the native ecosystem. There are about 900 bitterlings in the only extant North American population. The oldest specimen was in its fourth summer (III+) and all were mature in their first year. Fecundity is low, less than 60 eggs per female. Bitterlings feed primarily on diatoms and the digestive system is typical of a surface-scraping herbivore. Impact of this exotic species on the ecosystem appears minimal. It is unlikely that the species would cause appreciable negative impact on any habitat in the northeastern United States.

82-002445 Shute, P. W.; J. R. Shute and D. G. Lindquist. AGE, GROWTH AND EARLY LIFE HISTORY OF THE WACCAMAW DARTER, *ETHEOSTOMA PERLONGUM*. *Copeia* 1982(3):561-567. 10 Aug. 1982. SFA 27(4)
[Dep. Zool., Univ. Tenn., Knoxville 37916] The examination of scales, otoliths and length frequency histograms indicates that *Etheostoma perlongum* is an annual darter. Adults die soon after spawning. Growth is rapid. Darters reach half average adult size between four and eight weeks. Females attain most of their adult size by month 5, and males continue to grow through month 9 (with the exception of "stunted" males in the population). Fertilized eggs are spherical, 1.2 mm in diameter, and hatch between 120 and 168 hours at 20-23 C in aquaria. Laboratory reared larvae show a full complement of 38 myomeres by 4.9 mm SL, and become juvenile by 10.2 mm SL.

82-002446 Sreenivasan, P. V. OBSERVATIONS ON THE FISHERY AND BIOLOGY OF *MEGALASPIS CORDYLA* (LINNAEUS) AT VIZHINJAM. *Indian J. Fish.* 25(1-2):122-140. 1978. SFA 27(4)

82-002447 Tremblay, C. and F. Axelsen. BIOLOGIE ET PÊCHE DU FLÉTAN DU GROENLAND *REINHARDTIUS HIPPOGLOSSOIDES* (WALBAUM) DANS LE GOLFE DU SAINT-LAURENT. [BIOLOGY AND FISHERIES OF GREENLAND HALIBUT *REINHARDTIUS HIPPOGLOSSOIDES* (WALBAUM) OF THE GULF OF ST. LAWRENCE.] *Trav. Pech. Que.* No. 48. 101p. 1981. In French with English summ. SFA 27(4)
[Dir. Rech. Sci. Tech., 2700 rue Einstein, Ste-Foy, Quebec, Canada]

82-002448 Tugarina, P. Y. and V. S. Khramtsova. THE ECOLOGY OF THE AMUR GRAYLING, *THYMALLUS GRUBEI*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):10-25. 1981. SFA 27(4)
[Inkutsh State Univ., USSR]

82-002449 Weber, J. J. and B. L. Les. SPAWNING AND EARLY LIFE HISTORY OF YELLOW PERCH IN THE LAKE WINNEBAGO SYSTEM. *Wis. Dep. Nat. Resour. Tech. Bull.* No. 130. 48p. 1982. SFA 27(4)

LIFE HISTORY-GENERAL WORKS (CONTINUED)

82-002449 CONTINUED

Considerable year-to-year variation was observed in the timing of spawning and characteristics of the spawning population. Spawning began as early as 31 March and as late as 25 April, its initiation showing little relationship to any environmental factor except ice breakup in Lake Winnebago. Spawning duration varied positively with water level. Number of migrating perch increased with flow except in one year of exceptionally high flow. Age and size compositon of the spawning population was typically unimodal or bimodal, reflecting the dominance of one or two strong year classes. Spawning males were age II and older and females age III and older. Males outnumbered females an average of 2-7 times, but sex ratios as high as 51:1 were observed on a daily basis. Migration by size groups was evident, but no single pattern was observed for all study years. Calculated growth of a spring sample of spawning fish from the Fox River and a fall sample from Lake Winnebago showed that growth was greatest during the first and second years of life for length and during the fourth and fifth years for weight. Females exhibited a growth advantage over males after the first year of life. Eggs began hatching within 11-15 days after fertilization with water temperatures ranging from 2.7-21.6C. Immigration of larval perch to Lake Winnebago was confirmed by meter net captures at the river's entrance to the lake. Young perch averaged 27 mm by mid-June, when the demersal stage was reached, and 78-90 mm by the end of sampling in October. Growth was sigmoidal for both length and weight. Relative abundance of young perch sampled by trawl dropped sharply by August in all study years, suggesting that year class strength is set at midsummer of the first year of life. No correlation was found between year class strength for 13 years and May-August water temperatures in Lake Winnebago and Fox River flow during April and May. Relative abundance was not a factor in growth or mortality of young-of-the-year perch. June-October mortality of trawling-sampled perch ranged from 39 to 87% and was inversely related to mortality of seine-captured perch for the same period. Detailed food habit studies indicated all but the largest young-of-the-year perch are primarily zooplankton feeders. Food items consumed were diverse and variable, changing with habitat (littoral vs. limnetic), year and size of fish. Wide year-to-year variations were found in many aspects of yellow perch biology covered in this 6-year study, indicating the importance of long-term research on this species.--From abstr.

82-002450 Yáñez-Arancibia, A.; J. Curiel-Gómez and V. L. De Yáñez. PROSPECCIÓN BIOLÓGICA Y ECOLÓGICA DEL BAGRE MARINO *GALEICHTHYS CAERULESCENS* (GUNTHER) EN EL SISTEMA LAGUNAR COSTERO DE GUERRERO, MÉXICO (PISCES: ARIIDAE). [BIOLOGICAL AND ECOLOGICAL SURVEY OF SEA CATFISH *GALEICHTHYS CAERULESCENS* (GUNTHER) IN THE COASTAL LAGOONS SYSTEM OF GUERRERO, MEXICO (PISCES: ARIIDAE).] *An. Cent. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex.* 3(1):125-180. 1976. In Spanish with English summ. SFA 27(4)

[Cent. Cienc. Mar. Limnol., Univ. Nac. Auton. Mex., Cuidad Univ., Mexico 20, D.F.]

82-002451 Yáñez-Arancibia, A. OBSERVACIONES SOBRE *MUGIL CUREMA* VALENCIENNES EN ÁREAS NATURALES DE CRIANZA, MÉXICO. ALIMENTACIÓN, CRECIMIENTO, MADUREZ Y RELACIONES ECOLÓGICAS. [OBSERVATIONS ON *MUGIL CUREMA* VALENCIENNES IN NATURAL BREEDING AREAS IN MEXICO. FEEDING, GROWTH, MATURITY AND ECOLOGICAL RELATIONSHIPS.] *An. Cent. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex.* 3(1):93-124. 1976. In Spanish with English summ. SFA 27(4)

[Cent. Cienc. Mar. Limnol., Univ. Nac. Auton. Mex., Cuidad Univ., Mexico 20, D.F.]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

82-002452 Yáñez-Arancibia, A. and F. Amezcua-Linares. ECOLOGÍA DE *UROLOPHUS JAMAICENSIS* (CUVIER) EN LAGUNA DE TÉRMINOS UN SISTEMA ESTUARINO DE SUR DEL GOLFO DE MÉXICO. (PISCES: UROLOPHIDAE). [AN ECOLOGICAL STUDY OF *UROLOPHUS JAMAICENSIS* (CUVIER) IN TERMINOS LAGOON, AN ESTUARINE SYSTEM IN SOUTHERN GULF OF MEXICO. (PISCES: UROLOPHIDAE).] *An. Cent. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex.* 6(2):123-136. 1979. In Spanish with English summ. SFA 27(4)
[Cent. Cienc. Mar. Limnol., Univ. Nac. Auton. Mex., Cuidad Univ., Mexico 20, D.F.]

82-002453 Yohannan, T. M. STUDIES ON THE MACKEREL FISHERY OF MANGALORE AREA DURING 1969-73. *Indian J. Fish.* 24(1-2):113-123. 1977. SFA 27(4)

82-002454 Zuerlein, G. THE WHITE PERCH IN NEBRASKA. *Nebr. Game Parks Comm. Tech. Ser.* No. 8. 108p. 1981. SFA 27(4)
[Nebr. Game Parks Comm., Lincoln]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

82-002455 Bahr, L. M., Jr.; J. W. Day, Jr. and J. H. Stone. ENERGY COST-ACCOUNTING OF LOUISIANA FISHERY PRODUCTION. *Estuaries* 5(3):209-215. Sept. 1982. SFA 27(4)
[Cent. Wetland Resour., La. State Univ., Baton Rouge 70803] A quantitative relationship between gross primary production and secondary production of aquatic upper level consumers was derived for the inshore portion of the Louisiana coastal zone. We estimate that 1,700 units of gross primary production are requred to produce one unit of upper level consumers. Lower and mid-level consumers are estimated to require lesser amounts, 300 and 600 units, respectively. Harvested fishery groups in the inshore ecosystem represented a total average of about 23,000 metric tons (dry wt) or about 1.2×10^{11} Kcal (5.0×10^{11} KJ) annually. This harvest "costs" the system about 7×10^{13} Kcal (3.3×10^{14} KJ) of gross primary production, or an equivalent of 4×10^{14} Kcal (1.7×10^{15} KJ) of fossil fuel.

82-002456 Best, E. A. and W. H. Hardman. JUVENILE HALIBUT SURVEYS, 1973-1980. *Int. Pac. Halibut Comm. Tech. Rep.* No. 20. 38p. 1982. SFA 27(4)
[P.O. Box 5009, University Station, Seattle, WA 98105]

82-002457 Dhulkhed, M. H. and K. Uma Kumari. RELATIVE ABUNDANCE OF AGE GROUPS OF OILSARDINE AND ITS EFFECT ON FISHERY OF MANGALORE AREA. *Indian J. Fish.* 26(1-2):40-46. 1979. SFA 27(4)
[Mangalore Res. Cent., Cent. Mar. Fish. Res. Inst., Mangalore, India]

82-002458 Gnad, J. D. POPULATION STUDIES OF THE GUPPY, *POECILIA RETICULATA* (POECILIIDAE, PISCES). *Ph.D. dissertation, State Univ. N.Y. (Binghamton)* 208p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(3):649. Sept. 1982. SFA 27(4)

82-002459 Gordon, D. J. and H. R. MacCrimmon. JUVENILE SALMONID PRODUCTION IN A LAKE ERIE NURSERY STREAM. *J. Fish Biol.* 21(4):455-473. Oct. 1982. SFA 27(4)

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

82-002459 CONTINUED

[Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Normandale Creek (2531 m^2) provides spawning and nursery grounds for lake-run rainbow trout, *Salmo gairdneri* Richardson, brown trout, *Salmo trutta* L., and coho salmon, *Oncorhynchus kisutch* (Walbaum). Upstream movements are significantly correlated with peak stream discharge ($P<0.05$). In 1973-1974, 59 adult salmonids constructed 86 nests of which 60% were disturbed by re-use or sand deposition. From a calculated deposition of 90,400 ova, 483 juveniles, 6 cm in fork length (F.L.), were resident in the stream when estimates by electrofishing first became valid. Estimated within-stream (i.e. all sections combined) monthly densities of wild juveniles > 6 cm F.L., ranged from six to 22 fish $(100\ m^2)^{-1}$, and biomass from 1.3 to 3.1 gm^{-2}. The highest within-section biomass was 8.3 gm^{-2} in November. Additions of hatchery-reared rainbow trout temporarily increased monthly within-stream juvenile density up to 23 fish $(100\ m^2)^{-1}$, and biomass to 8.2 gm^{-2}. Density and biomass were positively correlated ($P<0.05$) with both instream and bank cover, and biomass negatively correlated ($P<0.05$) with gradient. The importance of substratum and flow characteristics on juvenile density and biomass was strongly indicated although not statistically significant. Annual within-section production of juveniles <6cm F.L. ranged from 4.79 to 5.93 gm^{-2} year $^{-1}$ in Sections III and IV, Respectively. Inclusion of calculated probable numbers of fish <6cm F.L. increased within-section production from 5.93 to 18.65 gm^{-2} year $^{-1}$ in upstream Section IV.

82-002460 Green, D. M. POPULATION DYNAMICS AND MANAGEMENT OF LARGEMOUTH BASS (*MICROPTERUS SALMOIDES*) AND CHAIN PICKEREL (*ESOX NIGER*) IN DRYDEN LAKE, NEW YORK. *Ph.D. dissertation, Cornell Univ.* 163p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(4):968. Oct. 1982. SFA 27(4)

Population dynamics, growth, biomass and food habits of largemouth bass and chain pickerel and number and biomass of associated species in Dryden Lake were determined in 1965-1971. Second year survival of bass was highly variable and positively correlated with age 0 length in October. Bass growth was closely correlated with May to October temperatures. Beyond age 1 annual survival averaged 0.60 and total mortality was equally proportioned between summer and winter. Over 70% of the natural mortality occurred over winter. Survival of pickerel from age 0 to I was also highly variable, but was not as closely correlated with first year growth as with bass. Beyond age I annual survival of pickerel decreased with age from 0.63 at age III to 0.16 for age V and older. About 70% of the total mortality occurred over summer. Annual natural mortality increased with age from 0.26 at age II to 0.65 for V and older pickerel and was highest over winter. Although biomass of bass and pickerel was moderately high (mean 42 kg/ha), prey species were extremely abundant and, in general, slow growing. Biomass of brown bullhead, pumpkinseed, yellow perch, creek chubsucker and black crappie $\geq$15.2 cm averaged 208 kg/ha and numbers averaged 1380/ha. The complex environment created by extensive beds of aquatic plants may have decreased availability of prey species to predators. The effect of different minimum length limits on yield per recruit was examined. Maximum yield in weight occurred at minimum size limits of 12 and 14 in for bass and pickerel, respectively. Yield in weight was fairly insensitive to changes in minimum size limits over the range examined except yield of pickerel would be substantially lower at a 16 in limit. Biomass and yield in numbers of larger fish would increase if size limits were increased about the 10 in (bass) and 12 in (pickerel) limits in effect during the study. Gains in yield and improved size structure may be less than predicted from the model in complex environments like Dryden Lake. Despite high numbers of prey, growth of predators was modest and was despressed when large cohorts were produced.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

82-002461 Hardin, T. S. A BIOLOGICAL AND ECONOMIC EVALUATION OF TROUT PRODUCTION IN PERUVIAN LAKES. *Ph.D. dissertation, Colo. State Univ.* 121p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(3):601. Sept. 1982. SFA 27(4)

82-002462 Hardin, T. S. BIOLOGY AND ECONOMICS OF PERU'S HIGH-ALTITUDE FISHERY. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:33-41. 1982. Available @ $10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)
[1203 Remington, Fort Collins, CO 80524]

82-002463 Havey, K. A.; D. O. Locke and C. L. Smith. A COMPARISON OF FOUR METHODS OF ESTIMATING POPULATIONS OF HATCHERY-REARED BROOK TROUT AT TOMAH LAKE, MAINE. *N. Am. J. Fish. Manage.* 1(2):186-192. 1981. SFA 27(4)
[Me. Dep. Inland Fish. Wildl., 34 Idaho Ave., Bangor 04401]

82-002464 Hesse, L. W. and B. A. Newcomb. ON ESTIMATING THE ABUNDANCE OF FISH IN THE UPPER CHANNELIZED MISSOUR RIVER. *N. Am. J. Fish. Manage.* 2(1):80-83. 1982. SFA 27(4)
[Nebr. Game Parks Comm., Fish. Div., P.O. Box 934, Norfolk 68701]

82-002465 Hightower, J. E.; R. J. Gilbert and T. B. Hess. SHORELINE AND COVE SAMPLING TO ESTIMATE SURVIVAL OF YOUNG LARGEMOUTH BASS IN LAKE OCONEE, GEORGIA. *N. Am. J. Fish. Manage.* 2(3):257-261. 1982. SFA 27(4)
[Ga. Coop. Fish. Res. Unit, Sch. For. Resour., Univ. Ga., Athens 30602]

82-002466 Kanno, Y. [ON THE SUBPOPULATION OF HERRING *CLUPEA PALLASII* IN THE OKHOTSK SEA ADJACENT TO HOKKAIDO.] *Bull. Jpn. Soc. Sci. Fish.* 48(6):755-762. June 1982. In Japanese with English summ. SFA 27(4)
[Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

82-002467 Khan, R. A.; M. Dawe; R. Bowering and R. K. Misra. BLOOD PROTOZOA AS AN AID FOR SEPARATING STOCKS OF GREENLAND HALIBUT, *REINHARDTIUS HIPPOGLOSSOIDES*, IN THE NORTHWESTERN ATLANTIC. *Can. J. Fish. Aquatic Sci.* 39(9):1317-1322. Sept. 1982. In English with French summ. SFA 27(4)
[Dep. Biol., Memorial Univ. Newfoundland, St. Johns, NF A1C 5S7, Canada]

82-002468 Luey, J. E. POPULATION DYNAMICS OF RAINBOW SMELT (*OSMERUS MORDAX*) IN WESTERN LAKE SUPERIOR. *Ph.D. dissertation, Univ. Minn.* 106p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(1):22. July 1982. SFA 27(4)

82-002469 Mortensen, E. PRODUCTION OF TROUT, *SALMO TRUTTA*, IN A DANISH STREAM. *Environ. Biol. Fishes* 7(4):349-356. 15 Sept. 1982. SFA 26(4)
[Freshwater Lab., Nat. Agency Environ. Prot., 52 Lysbrogode, DK-8600 Silkeborg, Denmark]

82-002470 Otero, H. O. and M. A. Simonazzi. LOS RECURSOS PESQUEROS DEMERSALES DEL MAR ARGENTINO. PARTE I: EVALUACION DE LA BIOMASA (STANDING STOCK) DE LA MERLUZA COMUN (*MERLUCCIUS HUBBSI*) Y DE LA MERLUZA AUSTRAL (*MERLUCCIUS POLYLEPIS*) EN EL AREA DE SU DISTRIBUCION ESTIVAL. [THE DEMERSAL FISHERIES RESOURCES OF THE ARGENTINE SEA. PART I: STANDING STOCK EVALUATION OF THE COMMON HAKE (*MERLUCCIUS HUBBSI*) AND OF THE AUSTRAL HAKE

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

82-002470 CONTINUED (*MERLUCCIUS POLYLEPIS*) IN THE AREA OF THEIR SUMMER DISTRIBUTION.] *Riv. Invest. Desar. Pesq.* 2(2):5-12. 1980. In Spanish with English summ. SFA 27(4)
[INIDEP, Mar del Plata, Argentina]

82-002471 Parmanne, R. and V. Sjöblom. ABUNDANCE, MORTALITY AND PRODUCTION OF SPRING-SPAWNING BALTIC HERRING LARVAE IN THE SEAS AROUND FINLAND IN 1979. *Finn. Fish. Res.* 4:20-26. 1982. SFA 27(4)
[Finnish Game Fish. Res. Inst., Fish. Div., P.O. box 193, SF-00131 Helsinki 13, Finland]

82-002472 Pirogovskiy, M. I. and T. A. Fadeyeva. THE SIZE-AGE COMPOSITION OF THE SEVRYUGA, *ACIPENSER STELLATUS*, DURING THE MARINE PERIOD OF LIFE. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(4):54-63. 1981. SFA 27(4)
[TsNIORKh, Astrakhan, USSR]

82-002473 Ploskey, G. R. and R. M. Jenkins. BIOMASS MODEL OF RESERVOIR FISH AND FISH-FOOD INTERACTIONS, WITH IMPLICATIONS FOR MANAGEMENT. *N. Am. J. Fish. Manage.* 2(2):105-121. 1982. SFA 27(4)
[U.S. FWS, Natl. Reservoir Res. Prog., 100 West Rock St., Fayetteville, AR 72701]

82-002474 Randall, R. G. and U. Paim. GROWTH, BIOMASS, AND PRODUCTION OF JUVENILE ATLANTIC SALMON (*SALMO SALAR* L.) IN TWO MIRAMICHI RIVER, NEW BRUNSWICK, TRIBUTARY STREAMS. *Can. J. Zool.* 60(7):1647-1659. July 1982. In English with French summ. SFA 27(4)
[Mar. Fish Div., Dep. Fish Oceans, Biol. Stn., St. Andrews, NB E0G 2X0, Canada] The production rate of juvenile Atlantic salmon (*Salmo salar*) was estimated at four sites in two tributary streams of the Miramichi River, New Brunswick, during the period September 1976 to October 1978. Annual production ranged between 0.27 and 5.12 g/m^2/year^1. Growth was largely restricted to a 4-month period in early summer. Among the four sites, age 0+ salmon attained a mean weight of between 0.95 and 3.50 g by the end of their first growing season (September) and densities in July ranged between 0.3 and 3.1 fry/m^2. Age 1+ parr grew to mean weights between 4.95 and 12.45 g by September, and June-July densities ranged between 0.03 and 0.6 parr/m^2. Marking information indicated that most parr remained in the study sites from July to September, but larger proportions of migrant parr were recorded in October. Production during summer was directly and positively related to initial population densities. Production rates at these sites were lower than most other recorded values for juvenile Atlantic salmon. Biomass of salmon may have been below the carrying capacity of the environment at all four sites.

82-002475 Sjöblom, V. and R. Parmanne. ABUNDANCE OF BALTIC HERRING AND SPRAT OFF THE COAST OF FINLAND IN 1956-68 AND 1975-78 ACCORDING TO EXPLORATORY FISHING WITH A PELAGIC TRAWL. *Finn. Fish. Res.* 4:14-19. 1982. SFA 27(4)
[Dep. Limnol., Univ. Helsinki, Viikki, SF-00710 Helsinki 71, Finland]

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

82-002476 Aneer, G. and S. Nellbring. A SCUBA-DIVING INVESTIGATION OF BALTIC HERRING (*CLUPEA HARENGUS MEMBRAS* L.) SPAWNING GROUNDS IN THE ASKÖ-LANDSORT AREA, NORTHERN BALTIC PROPER. *J. Fish Biol.* 21(4):433-442. Oct. 1982. SFA 27(4)

[Askö Lab., Inst. Mar. Ecol., Univ. Stockholm, S-106 91 Stockholm, Sweden] In a spawning area survey in the Askö area, northern Baltic proper, undertaken in the beginning of summer 1978, 100 randomly established and sampled transects were studied by diving. Herring spawn was found at 45 of the transects. The eggs were usually found on *Pilayella littoralis*, a filamentous brown algae, at the more exposed transects. Eggs were only found down to a depth of 11 m. In a neighbouring oil spill area spawn were found at only four out of 20 transects. Of eggs taken to the laboratory for hatching, 54% of those from the unaffected area hatched but only 25% of those from the oil spill area.

82-002477 Baglin, R. E., Jr. REPRODUCTIVE BIOLOGY OF WESTERN ATLANTIC BLUEFIN TUNA. *NOAA Fish. Bull.* 80(1):121-134. Jan. 1982. SFA 27(4)

[NMFS, c/o Alaska Dep. Fish Game, P.O. Box 686, Kodiak 99615] Ovaries of bluefin tuna, *Thunnus thynnus*, were collected from the Gulf of Mexico, Florida Straits, Middle Atlantic Bight of the western North Atlantic, and off the northeast coast of the United States. There was relatively little development towards maturity in age 1 through age 7 fish from the Middle Atlantic Bight as evidenced by low gonosomatic index values and histological examination of ovaries. Well-developed ovaries were present in giant bluefin tuna from the Gulf of Mexico and Florida Straits, with heaviest spawning occurring in May. For bluefin tuna measuring 205-269 cm fork length and 156-324 kg round weight, the average number of eggs measuring 0.33 mm in diameter and larger was estimated at 60.3 million, and the average number of eggs measuring 0.47 mm in diameter and larger was estimated at 34.2 million.

82-002478 Beland, K. F.; R. M. Jordan and A. L. Meister. WATER DEPTH AND VELOCITY PREFERENCES OF SPAWNING ATLANTIC SALMON IN MAINE RIVERS. *N. Am. J. Fish. Manage.* 2(1):11-13. 1982. SFA 27(4)

[Atl. Sea-Run Salmon Comm., Water St., Machias, ME 04654]

82-002479 Billard, R. THE REPRODUCTIVE CYCLE IN TELEOST FISH. *Riv. It. Piscic. Ittiop.* 17(2):48-72. Apr.-May-June 1982. In English and Italian. SFA 27(4)

[Lab. Physiol. Poissons, I.N.R.A., 78350 Jouy-en-Josas, France]

82-002480 Birman, I. B. OCEAN MIGRATION AND ORIGIN OF SEASONAL RACES OF ANADROMOUS SALMON (SALMONIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(1):35-47. 1981. SFA 27(4)

[KoTINRO, Petropavlovsk-Kamchatskiy, USSR]

82-002481 Brown, L. and J. F. Downhower. POLYGAMY IN THE MOTTLED SCULPINS (*COTTUS BAIRDI*) OF SOUTHWESTERN MONTANA (PISCES: COTTIDAE). *Can. J. Zool.* 60(8):1973-1980. Aug. 1982. SFA 27(4)

[Dep. Biol., George Mason Univ., Fairfax, VA 22030] Relationships among nest sites, guardian male size, and male courtship success (number of matings per male) were examined in 11 populations of mottled sculpins (*Cottus bairdi*) in the Madison River in southwestern Montana during the 1978 and 1979 breeding seasons. The number of matings per breeding male ranged from 1 to 12. Sites used as nests were not a random sample of available sites but were larger than average-sized rocks on the stream bed. Larger males had larger nest sites. Male courtship success was sometimes correlated with nest size. The best predictor of male mating success was male size. These

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

82-002481 CONTINUED observations are consistent with the hypothesis that polygamy in mottled sculpins has evolved through female choice, not through resource defense.

82-002482 Buzeta, M. and K. G. Waiwood. FECUNDITY OF ATLANTIC COD (*GADUS MORHUA*) IN THE SOUTHWESTERN GULF OF ST. LAWRENCE. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 1110. iii + 6p. May 1982. In English with French summ. SFA 27(4)

[Biol. Stn., St. Andrews, NB E0G 2X0, Canada] Fecundity estimates were made on 30 Atlantic cod (*Gadus morhua*) specimens collected from the southwestern Gulf of St. Lawrence in 1980. Maturing ovaries were places in Gilson's fluid to free ripening oocytes from their follicles. Absolute fecundity was estimated by measuring the collective volume of eggs larger than 250∂, counting the number of eggs in 0.5-ml subsamples and adjusting by the appropriate multiplication factor. Fecundity-size relationships were evaluated, using regression analysis, and subsequently compared with those derived from previous studies for this and ohter cod populations. The fecundity-size relationship giving best fit was of the form $F = aW^b$, and the average relative fecundity was found to be 279 eggs/g of body weight. A method to reduce clumping of eggs and to increase efficiency of sample preparation is described. The contribution of non-follicular tissue to relative overy weight was estimated.

82-002483 Ciechomski, J. de and M. C. Cassia. REPRODUCCION Y FECUNDIDAD DEL SUREL (*TRACHURUS PICTURATUS AUSTRALIS*). [REPRODUCTION AND FECUNDITY OF THE JACK MACKEREL, *TRACHURUS PICTURATUS AUSTRALIS* OFF ARGENTINA, IN MAR DEL PLATA AREA.] *Riv. Invest. Desar. Pesq.* 2(2):39-45. 1980. SFA 27(4)

[INIDEP, Mar del Plata, Argentina]

82-002484 Cole, K. S. MALE REPRODUCTIVE BEHAVIOUR AND SPAWNING SUCCESS IN A TEMPERATE ZONE GOBY, *CORYPHOPTERUS NICHOLSI*. *Can. J. Zool.* 60(10):2309-2316. Oct. 1982. In English with French summ. SFA 27(4)

[Dep. Biol., Univ. Saskatchewan, Saskatoon, SK S7N 0W0, Canada] *Coryphopterus nicholsi* is a temperate zone marine goby. In laboratory groups of fish, females preferentially spawn with dominant males; assessment of dominance appears to be based upon courting vigour. Male size (standard length) and dominance were often, but not always, highly correlated. In contrast, there was no consistent correlation between territorial quality and spawning success. Smaller males in laboratory groups did not court females or guard eggs. However, their behaviour and testicular development during the reproductive season suggest that they may engage in sneak spawning. Dominant males are more likely to successfully guard eggs against conspecific predators than are subordinate males, and hence females should have greater reproductive success if they choose dominant males for spawning partners.

82-002485 Cooper, J. J. OBSERVATIONS ON THE REPRODUCTION AND EMBRYOLOGY OF THE LAHONTAN TUI CHUB, *GILA BICOLOR*, IN WALKER LAKE, NEVADA. *Great Basin Nat.* 42(1):60-64. 31 Mar. 1982. SFA 27(4)

[Bioresour. Cent., Desert Res. Inst., Reno, NV 89506] Various aspects of the reproduction and embryology of Walker Lake Lahontan tui chub, *Gila bicolor*, were investigated during the spring-summer period of 1976, 1977, and 1981. Tui chub were found to spawn in littoral regions of the lake beginning in late May or early June. Early in the season male chub substantially outnumbered females over the spawning grounds, with a normal 1:1 sex ratio gradually approached as the season progressed. The developmental period between fertilization to hatch-out was shortened by increases in water temperature. Selected stages of embryonic development are described from egg fertilization through post-hatch.

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

82-002486 Damas, T.; N. Millares; M. Borrero and E. González. FECUNDIDAD EN BIAJAIBA (*LUTJANUS SYNAGRIS*, LINNAEUS 1758). [FECUNDITY OF SNAPPER (*LUTJANUS SYNAGRIS*, LINNAEUS 1758).] *Rev. Cubana Invest. Pesq.* 4(3):18-23. 1979. In Spanish with English summ. SFA 27(4)
[Cent. Invest. Pesq., Miramar, Havana, Cuba]

82-002487 Dan, S. S. INTRAOVARIAN STUDIES AND FECUNDITY IN *NEMIPTERUS JAPONICUS* (BLOCH). *Indian J. Fish.* 24(1-2):48-55. 1977. SFA 27(4)

82-002488 Dan, S. S. MATURITY, SPAWNING AND FECUNDITY OF CATFISH *TACHYSURUS TENUISPINIS* (DAY). *Indian J. Fish.* 24(1-2):96-106. 1977. SFA 27(4)

Fecundity in *Tachysurus tenuispinis* of size range 28.5-42.4 cm varied from 29 to 82. It increased with increasing size. The linear relationship between weight and fecundity was more valid than that of length and fecundity. The fish breed once a year during May-September. The minimum size at first maturity was 27.5 cm total length. The females dominated the commercial catch and the male:female ratio was 1:1.79. Parental care noticed in males is described.

82-002489 Devadoss, P. MATURATION AND BREEDING HABIT OF *DASYATIS (AMPHOTISTIUS) IMBRICATUS* (SCHNEIDER) AT PORTO NOVO. *Indian J. Fish.* 25(1-2):29-34. 1978. SFA 27(4)

In *Dasyatis imbricatus* only the ovary and the uterus on the left side are functional. It has a prolonged breeding season from December to July and produces 1 or 2 embryos. The ova are ready for ovulation even before the parturition of the embryo in the uterus. The females reach maturity when they attain the size of 170-179mm as confirmed by the ponderal index. The males in the 160-169mm size group are mature as judged by the relationship between body length and clasper length. Sexes in the commercial catches vary--51.25% males to 48.75% females.

82-002490 Dorr, J. A. III; D. V. O'Connor; N. R. Foster and D. J. Jude. SUBSTRATE CONDITIONS AND ABUNDANCE OF LAKE TROUT EGGS IN A TRADITIONAL SPAWNING AREA IN SOUTHEASTERN LAKE MICHIGAN. *N. Am. J. Fish. Manage.* 1(2):165-172. 1981. SFA 27(4)
[Great Lakes Res. Div., Univ. Mich., Ann Arbor 48109]

82-002491 Dupuis, H. M. C. and M. H. A. Keenleyside. EGG-CARE BEHAVIOUR OF *AEQUIDENS PARAGUAYENSIS* (PISCES, CICHLIDAE) IN RELATION TO PREDATION PRESSURE AND SPAWNING SUBSTRATE. *Can. J. Zool.* 60(8):1794-1799. Aug. 1982. In English with French summ. SFA 27(4)
[Dep. Zool., Univ. Western Ontario, London, ON N6A 5B7, Canada]

82-002492 Fraser, J. M. AN ATYPICAL BROOK CHAR (*SALVELINUS FONTINALIS*) SPAWNING AREA. *Environ. Biol. Fishes* 7(4):385-388. 15 Sept. 1982. SFA 27(4)
[Ontario Minist. Nat. Resour., Box 50, Maple, ON L0J 1E0, Canada]

82-002493 Gross, M. R. SNEAKERS, SATELLITES AND PARENTALS: POLYMORPHIC MATING STRATEGIES IN NORTH AMERICAN SUNFISHES. *Z. Tierpsychol.* 60(1):1-26. Sept. 1982. SFA 27(4)

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

82-002493 CONTINUED

[Dep. Biol., Univ. Utah, Salt Lake City] In North American sunfishes (*Lepomis*: Centrarchidae) ♀♀ build nests and provide solitary parental care for the young. In this paper I provide for bluegill (*L. macrochirus*) a detailed account of ♀♀ which do not build nests, but steal fertilizations from the nests of other ♀♀. I begin by giving data on the behavior, morphology, and population demography of ♀♀. Next, through an analysis of individual male life-histories, I show that cuckoldry and parenting are discrete alternative reproductive strategies. This is followed by a theoretical analysis and an empirical test of cuckoldry and parental care as evolutionarily stable strategies (a mixed ESS). Several predictions are made concerning how natural selection will influence the life-history dynamics of these strategies. A general theory is then developed for sunfishes, and a first test made on the pumpkinseed (*L. gibbosus*). Finally, I note the parallels between male cuckoldry in sunfishes and precocial male life-histories in salmon and cichlids.

82-002494 Hails, A. J. and Z. Abdullah. REPRODUCTIVE BIOLOGY OF THE TROPICAL FISH *TRICHOGASTER PECTORALIS* (REGAN). *J. Fish Biol.* 21(2):157-170. Aug. 1982. SFA 27(4)

[Zool. Dep., Univ. Malaya, Lembah Pantai, Kuala Lumpur 22-11, Malaysia] The breeding cycle of an air-breathing Anabantid, *Trichogaster pectoralis* was studied in Malaysia. The species was found to breed all the year but with pronounced peaks of activity associated with the two wetter periods in the year. The advantages of this timing and the cues which stimulate gonadal activity are discussed. From the study of oocyte distribution in selected ovaries it was concluded that *T. pectoralis* is a total spawner although a batch of ripe oocytes may be released over an extended period of time. Fecundity was found to be related to length of fish by the formula ($\log_{10}$ Egg no.)=-4.6854+4.3080 $\log_{10}$ standard length (s.l.) (mm).

82-002495 Ivanova, M. N. and V. M. Volodin. VARIABILITY IN RATE OF SEXUAL MATURATION IN FRESHWATER POPULATIONS OF THE SMELT, *OSMERUS EPERLANUS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(3):28-37. 1981. SFA 27(4)

[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl Reg., USSR]

82-002496 Jonsson, B. and K. Hindar. REPRODUCTIVE STRATEGY OF DWARF AND NORMAL ARCTIC CHARR (*SALVELINUS ALPINUS*) FROM VANGSVATNET LAKE, WESTERN NORWAY. *Can. J. Fish. Aquatic Sci.* 39(10):1404-1413. Oct. 1982. In English with French summ. SFA 27(4)

Dir. Wildl. Freshwater Fishes, Res. Stn. Freshwater Fishes at Ims, Ims, N-4300 Sandnes, Norway]

82-002497 Kortmulder, K. ETHO-ECOLOGY OF SEVENTEEN *BARBUS* SPECIES (PISCES; CYPRINIDAE). *Neth. J. Zool.* 32(2):144-168. Aug. 1982. SFA 27(4)

[Zool. Lab., Kaiserstraat 63, 2300 RA Leiden, Netherlands]

82-002498 Krykhtin, M. L. and E. I. Gorbach. REPRODUCTIVE ECOLOGY OF THE GRASS CARP, *CTENOPHARYNGODON IDELLA*, AND THE SILVER CARP, *HYPOPHTHALMICHTHYS MOLITRIX*, IN THE AMUR BASIN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):109-123. 1981. SFA 27(4)

[AoTINRO, Khabarovsk, USSR]

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

82-002499 Ludqvist, H. and G. Fridberg. SEXUAL MATURATION VERSUS IMMATURITY: DIFFERENT TACTICS WITH ADAPTIVE VALUES IN BALTIC SALMON (*SALMO SALAR* L.) MALE SMOLTS. *Can. J. Zool.* 60(8):1822-1827. Aug. 1982. In English with French summ. SFA 27(4)
[Dep. Ecol. Zool., Univ. Umeå, S-901 87 Umeå,Sweden]

82-002500 Mojumder, P. MATURITY AND SPAWNING OF THE CAT FISH *TACHYSURUS THALASSINUS* (RUPPEL) OFF WALTAIR COAST. *Indian J. Fish.* 25(1-2):109-121. 1978. SFA 27(4)
Tachysurus thalassinus breeds once a year, during April to August, with peak period between May and July. The fish probably breeds in deep offshore waters which are not fished regularly at present. The average length and fish maturity is 36cm. The sexes are equally distributed in the commercial catch. Fecundity (total number of mature eggs per female) varies between 25 and 42. Parental care is exhibited by males.

82-002501 Moore, R. SPAWNING AND EARLY LIFE HISTORY OF BARRAMUNDI, *LATES CALCARIFER* (BLOCH), IN PAPUA NEW GUINEA. *Aust. J. Mar. Freshwater Res.* 33(4):647-661. 1982. SFA 27(4)
[P.O. Box 35, Thursday Island, Queensland 4875, Australia] *L. calcarifer* in western Papua is catadromous, undertaking substantial migrations to specific spawning grounds. The location and environmental characteristics of these spawning grounds and possible spawning stimuli are discussed. The annual spawning period extends from October to February but that for individual fish is relatively short. Fecundity (F) varies from $2.3 X10^6$ to $32.2 X10^6$ within the weight range 7.7-20.8kg, being related to the total weight W (in kilograms) by the relatioship $F=1.942WX10^6-13.816X10^6$. The eggs, larvae and juveniles are described. Larvae leave coastal waters when approximately 5mm long and enter coastal nursery swamps where they remain until the attain a length of 200-300mm. They then return to coastal waters as the nursery swamps begin to dry out (June-July).

82-002502 Neudecker, S. and P. S. Lobel. MATING SYSTEMS OF CHAETODONTID AND POMACANTHID FISHES AT ST. CROIX. *J. Comp. Ethol.* 59(4):299-318. Aug. 1982. SFA 27(4)
[Natl. Underwater Lab. Syst., Fairleigh Dickinson Univ., West Indies Lab., Christiansted, St. Croix, U.S. Virgin Islands]

82-002503 Pati, S. ON THE MATURATION AND SPAWNING OF CHINESE POMFRET *PAMPUS CHINENSIS* (EUPHRASEN) FROM ORISSA COAST. *Indian J. Fish.* 26(1-2):150-162. 1979. SFA 27(4)
[Dep. Zool., Ravenshaw Coll., Cuttach, Orissa, India]

82-002504 Patzner, R. A. DIE REPRODUKTION DER MYXINOIDEN. EIN VERGLEICH VON *MYXINE GLUTINOSA* UND *EPTATRETUS BURGERI*. [THE REPRODUCTION OF MYXINOIDS. A COMPARISON OF *MYXINE GLUTINOSA* AND *EPTATRETUS BURGERI*.] *Zool. Anz.* 208(3-4):132-144. 1982. In German with English summ. SFA 27(4)
[Zool. Inst. Univ., Akademiestr. 26, A-5020 Salzburg, Austria]

82-002505 Raina, H. S. OBSERVATIONS ON THE FECUNDITY AND SPAWNING BEHAVIOUR OF *SCHIZOTHORAX ESOCINUS* HECKEL FROM DAL LAKE, KASHMIR. *Indian J. Fish.* 24(1-2):201-203. 1977. SFA 27(4)

SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC. (CONTINUED)

82-002506 Sil'yanova, Z. S. OOGENESIS AND STAGES OF MATURITY OF FISHES OF THE FAMILY NOTOTHENIIDAE. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(4):81-89. 1981. SFA 27(4)
[VNIRO, Moscow, USSR]

82-002507 Somasekharan Nair, K. V. MATURITY AND SPAWNING OF *JOHNIUS (JOHNIEOPS) SINA* (CUVIER) AT CALICUT DURING 1969-72. *Indian J. Fish.* 24(1-2):15-24. 1977. SFA 27(4)

82-002508 Sunder, S. and C. B. Joshi. PRELIMINARY OBSERVATIONS ON THE SPAWNING OF *TOR PUTITORA* (HAMILTON) IN ANJI STREAM, JAMMU PROVINCE DURING 1969. *Indian J. Fish.* 24(1-2):253-258. 1977. SFA 27(4)

82-002509 Tanaka, Y.; K. Suzuki and A. Doi. [REPRODUCTION AND EARLY LIFE HISTORY OF THE GOBIOID FISH, *ELEOTRIODES HELSDINGENI* BLEEKER.] *J. Fac. Mar. Sci. Technol. Tokai Univ.* No. 15. p. 367-376. 1982. In Japanese with English summ. SFA 27(4)

82-002510 Tokranov, A. M. RATE OF SEXUAL MATURATION AND FECUNDITY OF THE STAGHORN SCULPIN, *GYMNOCANTHUS DETRISUS* (COTTIDAE), OFF THE EAST COAST OF KAMCHATKA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(1):76-82. 1981. SFA 27(4)
[KoTINRO, Petropavlovsk-Kamchatskiy, USSR]

82-002511 Wagner, W. C. REPRODUCTION OF PLANTED LAKE TROUT IN LAKE MICHIGAN. *N. Am. J. Fish. Manage.* 1(2):159-164. 1981. SFA 27(4)
[Mich. Dep. Nat. Resour., Marquette Fish. Res. Stn., Marquette 49855]

82-002512 Warner, R. R. MATING SYSTEMS, SEX CHANGE AND SEXUAL DEMOGRAPHY IN THE RAINBOW WRASSE, *THALASSOMA LUCASANUM*. *Copeia* 1982(3):653-661. 10 Aug. 1982. SFA 27(4)
[Mar. Sci. Inst., Univ. Calif., Santa Barbara 93106]

82-002513 Yuuki, Y. [SPAWNING AND MATURITY OF A STERNOPTYCHID FISH *MAUROLICUS MUELLERI* IN THE SOUTH WESTERN WATERS OF THE SEA OF JAPAN.] *Bull. Jpn. Soc. Sci. Fish.* 48(6):749-753. June 1982. In Japanese with English summ. SFA 27(4)
[Shimane Pref. Fish. Exp. Stn., Setogashima, Hamada 697, Japan]

82-002514 Zelenkov, V. M. EARLY GAMETOGENESIS AND SEX DIFFERENTIATION IN THE PERCH, *PERCA FLUVIATILIS*. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):124-130. 1981. SFA 27(4)
[PINRO, Murmansk, USSR]

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC.

82-002515 Beecher, H. A. and W. C. Hixson. SEASONAL ABUNDANCE OF FISHES IN THREE NORTHWEST FLORIDA RIVERS. *Fla. Sci.* 45(3):145-171. 1982. SFA 27(4)
[Wash. Dep. Game, 600 N. Capitol Way, Olympia 98504] The seasonal abundances of 39 fish species in electrofishing collections were compared in the Escambia, Choctawhatchee, and Apalachicola rivers in northwest Florida. Relative abundances, as indicated by catch per unit effort of electrofishing,

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

82-002515 CONTINUED were examined in the Escambia River. *Lepisosteus osseus*, *Dorosoma cepedianum*, *D. petenense*, and *Mugil cephalus* were abundant during winter and spring high water in all 3 rivers, but seasonal patterns were less distinct in the larger Apalachicola. These seasonal euryhaline fishes and the catostomids contributed the greatest amounts to the fish biomass in the Escambia River. The abundance of *Carpiodes cyprinus* declined in the fall during low water, despite increased catch rates of other resident fishes. Female *C. velifer* outnumbered males during summer, but in winter sex ratios approached 1:1. Male *C. velifer* were more numberous downstream in late summer. A mark-and-recapture study of *Moxostoma poecilurum*, a dominant resident in the Escambia River, indicated 1095±504 in a 1km segment of the Escambia River. *Lepomis macrochirus* and *L. megalotis* were 2 of the most abundant fishes in the Escambia River.

82-002516 Bernard, D. R. and E. K. Israelsen. INTER- AND INTRASTREAM MIGRATION OF CUTTHROAT TROUT (*SALMO CLARKI*) IN SPAWN CREEK, A TRIBUTARY OF THE LOGAN RIVER, UTAH. *Northwest Sci.* 56(2):148-158. May 1982. SFA 27(4)
[Alaska Dep. Fish Game, 333 Raspberry Rd., Anchorage 99502] We investigated inter- and intrastream movements of fluvial cutthroat trout (*Salmo clarki*) within Spawn Creek and between this stream and the Logan River, Utah. From November 1973 through November 1975, we captured all migrants with a fish trap on Spawn Creek and tagged adult cutthroat trout. Monthly from July 1973 through November 1975, we electrofished parts of Spawn Creek and cold-branded all unmarked juveniles and adults. Also, we continuously measured water temperature and stream flows at the trap. During the spawning season in 1974, 39 cutthroat trout entered Spawn Creek and 23 left; and in 1975, 77 fish entered and 71 left the stream. Spawning migrants entered Spawn Creek when spring freshets from melting snow increased stream flows and turbidity. Tag returns from fishermen indicated adult cutthroat trout traveled to the Logan River after leaving Spawn Creek. In 1974, 229 and in 1975, 359 cutthroat trout fry left Spawn Creek in early fall when dwindling stream flows reduced habitat along stream margins. Migratory patterns of adults and fry show cutthroat trout use Spawn Creek for spawning and the Logan River for growing. Spawn Creek contains extensive spawning habitat with little deep-water habitat while the Logan River is its complement. In 1974 and 1975, respectively, 30 and 13 cutthroat trout (age 1 and older) constituted fall runs into Spawn Creek. Intrastream movements of cutthroat trout within Spawn Creek were extensive, with 35 percent of recaptured fish having moved from where released.

82-002517 Combs, D. L. and L. R. Peltz. SEASONAL DISTRIBUTION OF STRIPED BASS IN KEYSTONE RESERVOIR, OKLAHOMA. *N. Am. J. Fish. Manage.* 2(1):66-73. 1982. SFA 27(4)
[Northeast Reg. Off., Okla. Dep. Wildl. Conserv., Rt. 1, Box 75-B, Porter 74454]

82-002518 Conover, D. O. and S. A. Murawski. OFFSHORE WINTER MIGRATION OF THE ATLANTIC SILVERSIDE, *MENIDIA MENIDIA*. *NOAA Fish. Bull.* 80(1):145-150. Jan. 1982. SFA 27(4)
[Mar. Sci. Res. Cent., State Univ. N.Y., Stony Brook 11794]

82-002519 Dewey, M. R. SEASONAL ABUNDANCE, MOVEMENT AND DIVERSITY OF FISHES IN AN OZARK STREAM. *Arkansas Acad. Sci. Proc.* 35:33-39. 1981. SFA 27(4)
[U.S. FWS, P.O. Box 705, Ouachita Baptist Univ., Arkadelphia, AR 71923]

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

82-002520 Hourston, A. S. HOMING BY CANADA'S WEST COAST HERRING TO MANAGEMENT UNITS AND DIVISIONS AS INDICATED BY TAG RECOVERIES. *Can. J. Fish. Aquatic Sci.* 39(10):1414-1422. Oct. 1982. In English with French summ. SFA 27(4)
[Dep. Fish. Oceans, Resour. Serv. Br., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

82-002521 Hoyt, R. D. and W. H. Kruskamp. SEASONAL OCCURRENCES AND MOVEMENT PATTERNS OF FISH IN THE BARREN RIVER, KENTUCKY. *Trans. Ky. Acad. Sci.* 43(3-4):168-175. Sept. 1982. SFA 27(4)
[Dep. Biol., West. Ky. Univ., Bowling Green 42101] The Barren River, Kentucky was electrofished from October 1979 to August 1980 to determine seasonal occurrences and movement patterns of fishes in relation to discharges from Barren River Lake. The greatest number of fishes observed, primarily small gizzard shad, was during the winter months, paritcularly February. These small shad were observed throughout the study area of the Barren River and probably resulted from being drawn through the dam during periods of high discharge and upstream migration from the Green River. The greatest number of fishes per km of river sampled occurred in spring just below the dam. Movements of tagged fish were most evident in winter, but showed no upstream vs. downstream tendencies. The greatest distance travelled by any individual was 17 km. Fish capture was related significantly to water temperature and lake discharge, fish number being inversely related to temperature and directly related to discharge.

82-002522 Ikonen, E. MIGRATION OF RIVER-SPAWNING WHITEFISH IN THE GULF OF FINLAND. *Finn. Fish. Res.* 4:40-45. 1982. SFA 27(4)
[Finn. Game Fish. Res. Inst., Fish. Div., P.O. Box 193, SF-00131, Helsinki 13, Finland]

82-002523 Lyovin, A. V. DISTRIBUTION AND BEHAVIOR OF YOUNG RUSSIAN STURGEON, *ACIPENSER GULDENSTADTI* (ACIPENSERIDAE), IN THE CASPIAN SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):138-144. 1981. SFA 27(4)
[TsNIORKh, Astrakhan, USSR]

82-002524 Moore, R. and L. F. Reynolds. MIGRATION PATTERNS OF BARRAMUNDI, *LATES CALCARIFER* (BLOCH), IN PAPUA NEW GUINEA. *Aust. J. Mar. Freshwater Res.* 33(4):671-682. 1982. SFA 27(4)
[P.O. Box 35, Thursday Island, Queensland 4875, Australia] Adult *L. calcarifer* released in inland waters migrated to coastal spawning grounds, and those released on the spawning grounds returned to inland areas. Of 6369 fish tagged throughout western Papua, 978 (15.4%) recaptures were recorded, the maximum distance between release and recapture being 622 km. Tag recoveries indicated that these adult fish return to the same general area from which they originally migrated. Juveniles leave coastal nursery swamps when about 6 months old and by the end of their first year have become distributed throughout coastal and estuarine regions. During their second or third year they move into inland waters, although there is a residual population of all age classes that remains resident in coastal waters. Some 3-year-old, and a significant number of 4-year-old, fish undertake the annual migration from inland to coastal waters. Prevailing climatic conditions appear to affect the magnitude of this migration as not all of the adult fish migrate to coastal waters every year. Factors affecting this migration are discussed.

MOVEMENTS, SEASONAL AND DEPTH DISTRIBUTION, ETC. (CONTINUED)

82-002525 Peterson, N. P. IMMIGRATION OF JUVENILE COHO SALMON (*ONCORHYNCHUS KISUTCH*) INTO RIVERINE PONDS. *Can. J. Fish. Aquatic Sci.* 39(9):1308-1310. Sept. 1982. In English with French summ. SFA 27(4)
[Wash. Dep. Fish., Forks 98331]

82-002526 Sablin, V. V. and V. P. Pavlychev. THE INFLUENCE OF THERMAL CONDITIONS ON THE MIGRATION AND CATCH OF THE SAURY, *COLOLABIS SAIRA*, IN THE NORTH-WEST PACIFIC. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(3):21-27. 1981. SFA 27(4)
[TINRO, Vladivostok, USSR]

82-002527 Sameoto, D. VERTICAL DISTRIBUTION AND ABUNDANCE OF THE PERUVIAN ANCHOVY, *ENGRAULIS RINGENS*, AND SARDINE, *SARDINOPS SAGAX*, LARVAE DURING NOVEMBER 1977. *J. Fish Biol.* 21(2):171-185. Aug. 1982. SFA 27(4)
[Bedford Inst. Oceanogr., P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada]

82-002528 Savoie, L. B. and K. L. Casanova. A STUDY OF AREAL AND SEASONAL ABUNDANCE OF THE AMERICAN EEL (*ANGUILLA ROSTRATA*) AT SELECTED SITES IN SOUTHEASTERN COASTAL LOUISIANA. *La. Dep. Wildl. Fish. Tech. Bull.* No. 34. 27p. May 1982. SFA 27(4)

82-002529 Sugiwaka, K.; H. Tanaka; N. Kasahara and K. Araya. [SMOLT RUN IN THE SEA BY TAGGING EXPERIMENT OF POND-REARED SMOLT OF MASU SALMON (*ONCORHYNCHUS MASOU*).] *Sci. Rep. Hokkaido Fish Hatchery* No. 36. p. 11-31. Dec. 1981. In Japanese with English summ. SFA 27(4)
[Hokkaido Fish Hatchery, Nakanoshima, Toyohira-ku, Sapporo, Hokkaido, Japan]

FOODS/FEEDING

82-002530 Adams, S. M.; R. B. McLean and M. M. Huffman. STRUCTURING OF A PREDATOR POPULATION THROUGH TEMPERATURE-MEDIATED EFFECTS ON PREY AVAILABILITY. *Can. J. Fish. Aquatic Sci.* 39(8):1175-1184. Aug. 1982. In English with French summ. SFA 27(4)
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830]

82-002531 Allan, J. D. THE EFFECTS OF REDUCTION IN TROUT DENSITY ON THE INVERTEBRATE COMMUNITY OF A MOUNTAIN STREAM. *Ecology* 63(5):1444-1455. Oct. 1982. SFA 27(4)
[Dep. Zool., Univ. Md., College Park 20742] An experimental reduction in trout density was carried out for 4 yr to determine whether the numbers or species composition of aquatic invertebrates would be affected. In a Colorado stream, the standing crop of trout (mainly *Salvelinus fontinalis*) prior to this study was 4.86 g/m^2, typical of infertile trout streams. Repeated electroshocking of a 1220 m long experimental section kept trout stocks at 10-25% of this initial value during the summers of 1975-1978. Density of invertebrates in the benthos (number of invertebrates per square metre) showed no consistent differences between the trout removal section and upstream and downstream control sections for the majority of taxa examined. Drift density (number of invertebrates per 1000 cubic metres) also failed to show an effect of the trout removal. Some taxa were significantly more abundant at one site than another, but this was attributable to changes along the stream gradient or differences in phenology among the sites rather than experimental reduction of trout. As trout stomach content analysis

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82-002531 CONTINUED revealed very intensive grazing on a few taxa of aquatic insects, their failure to increase in the trout removal section was unexpected. Statistical analysis showed that because of the variability of the system, a doubling or halving of numbers must occur to be detectable. Within these limits, it is concluded that removal of trout had no significant effect on the prey community, and two explanations are offered. Trout may actually consume only a small fraction of total prey, although this conclusion is limited by inability of current techniques to sample the benthos fully. It is also likely that because streams do not provide areas where fish are predictably absent, the invertebrate community is highly adapted to fish predation and so is not sensitive to manipulations in fish density.

82-002532 Arai, M. N. and D. E. Hay. PREDATION BY MEDUSAE ON PACIFIC HERRING (*CLUPEA HARENGUS PALLASI*) LARVAE. *Can. J. Fish. Aquatic Sci.* 39(11):1537-1540. Nov. 1982. In English with French summ. SFA 27(4)
[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

82-002533 Axell, M. FEEDING OF COD IN THE ÅLAND SEA AND ITS INFLUENCE ON THE STOCKS OF HERRING AND SPRAT. *Finn. Fish. Res.* 4:35-39. 1982. SFA 27(4)
[Finn. Game Fish. Res. Inst., Fish. Div., Vaasa Field Stn., Rantakatu 28, SF-65120 Vaasa 12, Finland]

82-002534 Blay, J., Jr. and K. N. Eyeson. FEEDING ACTIVITY AND FOOD HABITS OF THE SHAD, *ETHMALOSA FIMBRIATA* (BOWDICH), IN THE COASTAL WATERS OF CAPE COAST, GHANA. *J. Fish Biol.* 21(4):403-410. Oct. 1982. SFA 27(4)
[K. N. Eyeson: Dep. Zool., Univ. Cape Coast, Cape Coast, Ghana] The monthly feeding activity and food habits of populations of *Ethmalosa fimbriata* occurring in the sea and an estuary in Cape Coast, Ghana district were investigated during a 14-month period. The juvenile fish, whose total length (T.L.) ranged from 5.3 to 14.7 cm, occur in the estuary and appeared to be more active feeders than the marine samples which measured 15.0-30.4 cm. The peak feeding activity in the marine population coincided with the onset of 'upwelling' in the sea, which period is characterized by high salinities, decreasing temperatures and high zooplankton production. The species is primarily a plankton feeder. The stomachs of the marine samples contained mainly protozoa, crustacea, molluscan larvae and a considerable amount of detritus while the stomachs of the estuarine fish contained mainly phytoplankton, protozoa, sand grains and organic detritus. These observations have been discussed in relation to other reports on populations occurring along the West African coast.

82-002535 Brown, L. R. and P. B. Moyle. THE IMPACT OF SQUAWFISH ON SALMONID POPULATIONS: A REVIEW. *N. Am. J. Fish. Manage.* 1(2):104-111. 1981. SFA 27(4)
[Wildl. Fish. Biol., Univ. Calif., Davis 95616]

82-002536 Courtois, R.; M. Simoneau and J. J. Dodson. INTERACTIONS MULTISPÉCIFIQUES: RÉPARTITION SPATIO-TEMPORELLE DES LARVES DE CAPELAN (*MALLOTUS VILLOSUS*), D'ÉPERLAN (*OSMERUS MORDAX*) ET DE HARENG DE L'ATLANTIQUE (*CLUPEA HARENGUS HARENGUS*) AU SEIN DE LA COMMUNAUTÉ PLANCTONIQUE DE L'ESTUAIRE MOYEN DU SAINT-LAURENT. [MULTISPECIES INTERACTIONS: SPATIAL AND TEMPORAL ORGANIZATION OF LARVAL CAPELAN (*MALLOTUS VILLOSUS*), SMELT (*OSMERUS MORDAX*) AND ATLANTIC HERRING (*CLUPEA HARENGUS HARENGUS*) IN THE PLANKTONIC COMMUNITY OF THE MIDDLE ESTUARY OF THE SAINT LAWRENCE.] *Can. J. Fish. Aquatic Sci.*

FOODS/FEEDING (CONTINUED)

82-002536 CONTINUED 39(8):1164-1174. Aug. 1982. In French with English summ. SFA 27(4)
[Dep. Biol., Univ. Laval, City Univ., Ste-Foy, PQ G1K 7P4, Canada]

82-002537 Cyrus, D. P. and S. J. M. Blaber. MOUTHPART STRUCTURE AND FUNCTION AND THE FEEDING MECHANISMS OF *GERRES* (TELEOSTEI). *S. Afr. J. Zool.* 17(3):117-121. 1982. In English with Afrikaans summ. SFA 27(4)
[Dep. Zool., Univ. Natal, Pietermaritzburg, South Africa]

82-002538 Danker, S. A. A FOOD HABIT STUDY OF THE SPOTTED SEATROUT, *CYNOSCION NEBULOSUS* CUVIER AND VALENCIENNES, IN MISSISSIPPI SOUND AND ADJACENT AREAS. *MS thesis, Miss. State Univ.* 45p. 1979. From Miss. State Univ. Library Pub. No. 19. p. 370-371. 1981. Abstract only. SFA 27(4)
A total of 569 spotted seatrout were collected from Mississippi Sound and adjacent areas during the period of March, 1977 to June, 1978. Sixty-two% (352) of the specimens collected had food materials in their stomachs while 38% (217) of them had empty stomachs. The main food items consumed by spotted seatrout were fish and shrimp. Shrimp alone were found in 31% of the stomachs examined. Fish alone were found in 41% of the stomachs examined indicating that the spotted seatrout is a preferential feeder. Fish were found to be the most common food organism in the stomachs of spotted seatrout in this area. Spotted seatrout showed definite preferences for certain groups of food organisms which were most abundant and easiest to obtain. Variations in diet due to size were determined by dividing specimens into four classes: I (0-80mm TL), II (81-150mm TL), III (151-300mm TL), and IV (301-643mm TL). The four size classes were analysed by seasons of the year: Quarter I (spring), II (summer), III (fall), and IV (winter).

82-002539 Devadoss, P. and P. K. M. Pillai. OBSERVATIONS ON THE FOOD AND FEEDING HABITS OF THE EEL, *MURAENESOX CINEREUS* (FORSKAL) FROM PORTO NOVO. *Indian J. Fish.* 26(1-2):244-247. 1979. SFA 27(4)
[Cent. Mar. Fish. Res. Inst., Mangalore, India] Feeding in *Muraenesox cinereus* was studied from the catches of hooks and line fishing operations from the catamarans. This fish is a carnivore and largely piscivorous, feeding on the pelagic, demersal and bottom living organisms. Cannibalistic tendency is noticed. Pelagic fishes like the mackerel and the clupeids are found mostly preferred.

82-002540 Devadoss, P. ON THE FOOD OF RAYS, *DASYATIS UARNAK* (FORSKAL), *D. ALCOCKII* (ANNANDALE) AND *D. SEPHEN* (FORSKAL). *Indian J. Fish.* 25(1-2):9-13. 1978. SFA 27(4)
Observations on the food of three sting rays, *Dasyatis uarnak*, *D. alcockii* and *D. sephen* were made separately. *D. uarnak* was observed to feed voraciously of both pelagic and benthic organisms. All the three are carnivores, feeding chiefly on fishes, crustaceans, molluscs and polychaetes.

82-002541 Frank, K. T. and W. C. Leggett. COASTAL WATER MASS REPLACEMENT: ITS EFFECT ON ZOOPLANKTON DYNAMICS AND THE PREDATOR-PREY COMPLEX ASSOCIATED WITH LARVAL CAPELIN *(MALLOTUS VILLOSUS)*. *Can. J. Fish. Aquatic Sci.* 39(7):991-1003. July 1982. In English with French summ. SFA 27(4)
[Dep. Biol., McGill Univ., Montreal, PQ H3A 1B1, Canada]

82-002542 Garman, G. C. IDENTIFICATION OF INGESTED PREY FISH BASED ON SCALE CHARACTERISTICS. *N. Am. J. Fish. Manage.* 2(2):201-203. 1982. SFA 27(4)
[Me. Coop. Fish. Res. Unit, 313 Murray Hall, Univ. Me., Orono 04469]

FOODS/FEEDING (CONTINUED)

82-002543 Harada, K. THE ATTRACTIVE EFFECT OF FOOD BASED ON THE BEHAVIORAL RESPONSES OF JUVENILE YELLOWTAIL *SERIOLA QUINQUERADIATA*. *Bull. Jpn. Soc. Sci. Fish.* 48(8):1047-1054. Aug. 1982. SFA 27(4)
[Lab. Biochem., Dep. Food Sci. Technol., Shimonoseki Univ. Fish. Shimonoseki 759-65, Japan]

82-002544 Hudd, R. FEEDING OF BALTIC HERRING LARVAE (*CLUPEA HARENGUS* L.) IN THE GULF OF FINLAND. *Finn. Fish. Res.* 4:27-34. 1982. SFA 27(4)
[Finn. Game Fish. Res. Inst., Fish. Div., Vaasa Field Stn., Rantakatu 28, SF-65120 Vaasa 12, Finland]

82-002545 Hyslop, E. J. THE FEEDING HABITS OF 0+ STONE LOACH, *NOEMACHEILUS BARBATULUS* (L.), AND BULLHEAD, *COTTUS GOBIO* L. *J. Fish Biol.* 21(2):187-196. Aug. 1982. SFA 27(4)
[Dep. Biol. Sci., Univ. Sokoto, Nigeria] The feeding habits of the 0+ year class of two of the most common small fish species in the River Ouzel, Milton Keynes, stone loach, *Noemacheilus barbatulus* (L.), and bullhead, *Cottus gobio* L., are assessed throughout the first growing season and compared. Despite similarities in the diets of the two species, differences in feeding behaviour and in morphology, especially in gape, may serve to reduce interspecific competition by partitioning of food resources.

82-002546 Imrie, D. M. G. and G. R. Daborn. FOOD OF SOME IMMATURE FISH OF MINAS BASIN, BAY OF FUNDY. *Proc. N.S. Inst. Sci.* 31(2):149-153. June 1981. In English with French summ. SFA 27(4)
[Dep. Biol., Acadia Univ., Wolfville, NS B0P 1X0, Canada] Stomach contents of juveniles of 11 species of fish collected in the southern bight of Minas Basin were examined. Most species, including typically planktivorous ones such as smelt (*Osmerus mordax*) and silversides (*Menidia menidia*), exhibited broad food spectra having both planktonic (copepods and meroplankton) and benthic (amphipods, isopods, cumaceans, and sedentary polychaetes) components. Only the blackspotted stickleback (Gasterosteus wheatlandi) was primarily planktivorous. The amphipod *Corophium volutator* appears to be a major food item for many juvenile fish in this region of Minas Basin. At times saltmarsh insects were also of considerable importance. The lack of feeding specialization may result from the extensive tidal fluctuations that stir up organisms from the benthos and wash out arthropods from nearby salt-marshes.

82-002547 Johnston, D. D. and D. J. Wildlish. EFFECT OF SUSPENDED SEDIMENT ON FEEDING BY LARVAL HERRING (*CLUPEA HARENGUS HARENGUS* L.). *Bull. Environ. Contam. Toxicol.* 29(3):261-267. Sept. 1982. SFA 27(4)
[Fish. Environ. Sci., Dep. Fish. Oceans, Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

82-002548 Kentouri, M. and P. Divanach. COMPORTEMENT ET RÉGIME ALIMENTAIRE DES LARVES DE MARBRÉ *LITHOGNATHUS MORMYRUS* (POISSON, TÉLÉOST., SPARIDAE) ÉLEVÉES DANS DES CONDITIONS DE CHOIX TROPHIQUE POLYSECIFIQUE ET PLURIDIMENSIONNEL. [BEHAVIOUR AND PREY SELECTION OF STRIPED SEA BREAM *LITHOGNATHUS MORMYRUS* LARVAE REARED IN POLYSPECIFIC AND PLURIDIMENSIONAL FOOD CONDITIONS.] *C. R. Hebd. Seances Acad. Sci. Ser. III Sci. Vie* 294(17):859-861. 10 May 1982. In French with English summ. SFA 27(4)
[Stn. Biol. Mar. Lagunaire, 34200 Sète, France] When having a wide choice, striped sea bream larvae select successively 4 type of preys: ciliata and veligers (2.9-3.5 mm), rotifers (4-7 mm), small pelagic crustacea up to 7mm. Digestibility of each prey class is very different.

FOODS/FEEDING (CONTINUED)

82-002548 CONTINUED Veligers, barnacles cypris and the rotifer *Cephalodella* remain alive in the gut.

82-002549 Kilambi, R. V. and A. Zdinak. FOOD INTAKE AND GROWTH OF HYBRID CARP (FEMALE GRASS CARP, *CTENOPHARYNGODON IDELLA* x MALE BIGHEAD, *ARISTICHTHYS (HYPOPHTHALMICHTHYS) NOBILIS*) FED ON ZOOPLANKTON AND *CHARA*. *J. Fish Biol.* 21(1):63-67. July 1982. SFA 27(4)
[Dep. Zool., Univ. Ark., Fayetteville 72701] Hybrid carp were raised in 1651 indoor tanks. Two tanks were used in this study each stocked with five fish (average total length and weight = 235.7 mm; 116.1 g); one tank was provided with zooplankton and the other with zooplankton and *Chara* sp. The hybrids fed actively on zooplankton at an average daily rate of 39% and *Chara* at 2.6% by body weight. Growth was estimated at 0.36% (0.43 g) per day. The hybrids on the two food types showed no significant differences either in plankton consumption or growth rate.

82-002550 Kohler, C. C. and J. J. Ney. A COMPARISON OF METHODS FOR QUANTITATIVE ANALYSIS OF FEEDING SELECTION OF FISHES. *Environ. Biol. Fishes* 7(4):363-368. 15 Sept. 1982. SFA 27(4)
[Fish. Res. Lab., South Ill. Univ., Carbondale 62901] Predator-prey data were obtained in a study of feeding ecology of land-locked alewife, *Alosa pseudoharengus*, in Claytor Lake, Virginia, and subjected to two indices of electivity as well as a nonparametric paired-comparisons statistical test. Values obtained from the two indices were often contradictory with each other and the statistical test. Attributes of the statistical procedure render it more appropriate than electivity indices to describe feeding selectivity in fish populations. Results of the study also demonstrated the importance of considering the size composition of zooplankton populations in prey preference studies; measures of selection were often positive for zooplankters ≧1.0 mm while negative for those of the same prey group <1.0 mm length. Because numerous problems are inherent with in situ feeding selectivity studies of planktivorous fishes, selectivity determinations, regardless of methodology, should be construed in a relative rather than absolute context.

82-002551 Kurian, A. INDEX OF RELATIVE IMPORTANCE - A NEW METHOD FOR ASSESSING THE FOOD HABITS OF FISHES. *Indian J. Fish.* 24(1-2):217-219. 1977. SFA 27(4)

82-002552 Langeland, A. INTERACTIONS BETWEEN ZOOPLANKTON AND FISH IN A FERTILIZED LAKE. *Holarctic Ecol.* 5(3):273-310. Sept. 1982. SFA 27(4)
[Univ. Trondheim Mus., N-7000 Trondheim, Norway] The effects of fish predation on the zooplankton community in an oligotrophic lake, Langvatn, near Trondheim in Central Norway, were investigated during a six-year period (1973-1978), together with the added effects of changes produced by adding artificial fertilizer in 1975 and 1976. The improved nutrient conditions in 1975 resulted in a rapid increase in biomass and production of the largest herbivore zooplankton species and of the fish population. A change in the behaviour and food habits of the arctic char was recorded; they became more pelagic and fed mainly on zooplankton. An increased survival rate of 0-group and biomass of planktivorous fish in 1975 enhanced the degree of fish predation on the zooplankton during subsequent years (1976-1978). As a consequence of fish predation, the composition of the zooplankton changed, from a mainly large-sized to a mainly small-sized community, dominated by *Bosmina longirostris* and rotifers. Since fish predation is size-selective and visibility-dependent, it induced a decrease in mean size and in body length at onset of maturity of the cladoceran populations and probably also weakened their ability to produce resting eggs.

FOODS/FEEDING (CONTINUED)

82-002553 Lazarus, S. OBSERVATIONS ON THE FOOD AND FEEDING HABITS OF *SARDINELLA GIBBOSA* FROM VIZHINJAM. *Indian J. Fish.* 24(1-2):107-112. 1977. SFA 27(4)

82-002554 Magnhagen, C. and A. Wiederholm. HABITAT AND FOOD PREFERENCES OF *POMATOSCHISTUS MINUTUS* AND *P. MICROPS* (GOBIIDAE) WHEN ALONE AND TOGETHER: AN EXPERIMENTAL STUDY. *Oikos* 39(2):152-156. Aug. 1982. In English with Russian summ. SFA 27(4)

[Dep. Zool., Uppsala Univ., Box 561, S-751 22 Uppsala, Sweden] Two closely related fish species, *Pomatoschistus minutus* (Pallas) and *P. microps* (Krøyer), live sympatrically on some shallow bottoms along the Swedish coast. Field samples showed that *P. minutus* was found in both the open and vegetated habitat while *P. microps* occurred mostly in open areas. In two kinds of laboratory experiments, in which the fish were offered a choice of habitat only and a choice of a combination of habitat and food, we examined if and how these species segregate. We found that *P. minutus* chose the two habitat types in equal proportions and was not influenced by the presence of *P. microps*. It ate of both prey items but seemed to prefer chironomid larvae to amphipods. On the other hand, *P. microps*, preferred the vegetated habitat and always took most of its food in that habitat. Food consumption rates were the same when each species was alone and when both were together. A certain amount of segregation thus occurs in sympatry because one of the species retreats into a subset of its entire niche, but there is nothing like complete segregation.

82-002555 Mallatt, J. PUMPING RATES AND PARTICLE RETENTION EFFICIENCIES OF THE LARVAL LAMPREY, AN UNUSUAL SUSPENSION FEEDER. *Biol. Bull. (Woods Hole)* 163(1):197-210. Aug. 1982. SFA 27(4)

[Dep. Zool., Wash. State Univ., Pullman 99164] The suspension feeding larvae of lampreys (ammocoetes) inhabit fine-grained sediments where particulate organic matter is concentrated, but whose low permeability limits the rate at which ammocoetes can pump water (flow rate). This study determined: 1) flow rates through the pharynges of ammocoetes, both within and out of the sediment, and 2) the ability of ammocoetes to filter particles from suspension (retention efficiency) over a wide range of algal cell concentrations (*Chlorella pyrenoidosa*, 1-75 mg/l). For most suspension feeders, flow rate and retention efficiency must be measured indirectly (clearance method). Direct measurement was possible here, as ammocoetes remain apparently undisturbed in glass tubes that allow the separation of inhalent from exhalent ventilatory currents. Problems arise in attempting to use clearance methods to determine flow rates in burrowed suspension feeders, and these problems are discussed. Ammocoete flow rates are exceptionally low compared to the rates of other suspension feeders, but retention efficiency was consistently high, even at the highest algal concentrations employed ($\bar{x}$=82%). While most suspension feeders rapidly process dilute suspensions, ammocoetes meet nutrient needs by slowly processing concentrated suspensions.

82-002556 Marrin, D. L. and D. C. Erman. EVIDENCE AGAINST COMPETITION BETWEEN TROUT AND NONGAME FISHES IN STAMPEDE RESERVOIR, CALIFORNIA. *N. Am. J. Fish. Manage.* 2(3):262-269. 1982. SFA 27(4)

[Dep. Hydrol. Water Resour., Univ. Ariz., Tuscon 85721]

82-002557 Mason, C. F. and S. M. MacDonald. THE IMPUT OF TERRESTRIAL INVERTEBRATES FROM TREE CANOPIES TO A STREAM. *Freshwater Biol.* 12(4):305-311. Aug. 1982. SFA 27(4)

[Dep. Biol., Univ. Essex, Wivenhoe Park, Colchester CO4 3SQ, England] The input of terrestrial invertebrates from different tree canopies to a trout stream was determined for a 28-week period from April to October, 1980.

FOODS/FEEDING (CONTINUED)

82-002557 CONTINUED Sycamore produced the greatest number of animals, followed by oak and alder. Ash was not significantly different from the controls. Coleoptera, Diptera, Homoptera and Arachnida made up the greatest number of animals caught, with Lepidoptera larvae important beneath oak. The input of biomass (gm^{-2} dry wt) was also greatest beneath sycamore (35.80), followed by oak (27.76), alder (20.39), ash (11.15) and control (9.92). The input of biomass was bimodal. The significance of terrestrial invertebrates as food for salmonids is discussed.

82-002558 Mauchline, J. THE PREDATION OF MYSIDS BY FISH OF THE ROCKALL TROUGH, NORTHEASTERN ATLANTIC OCEAN. *Hydrobiologia* 93(1-2):85-99. 6 Aug. 1982. SFA 27(4)
[Dunstaffnage Mar. Res. Lab., P.O. Box No. 3, Oban, Argyll, Scotland] The stomach contents of representatives of approximately 100 species of pelagic and demersal fish caught in the Rockall Trough, northeastern Atlantic Ocean, have been examined for the occurrence of mysids. More than 40 species of fish included mysids in their diets. The majority of the 21 species of mysids identified in the stomachs live in close association with the sediment and are rarely caught in pelagic nets. Mysids contributed significantly to the diets of many demersal fish but were not apparently important constituents of the food of pelagic fish.

82-002559 Mojumder, P. and S. S. Dan. STUDIES ON FOOD AND FEEDING HABITS OF CATFISH *TACHYSURUS TENUISPINIS* (DAY). *Indian J. Fish.* 26(1-2):115-124. 1979. SFA 27(4)
[Waltair Res. Cent., Cent. Mar. Fish. Res. Inst., Waltair, India] It is observed that 37% of the food of *Tachysurus tenuispinis*, consists of crabs, prawns, *Squilla* sp. and crustacean remains; 26% polychaetes, 6.5% molluscs, 6.3% teleosts, 4.2% ophiuroids and the rest miscellaneous food items. *T. tenuispinis* is, therefore, a carnivorous bottom feeder. As a single food item, polychaetes are most preferred. The fluctuations in the intensity of feeding (points) and the volume of stomach contents (ml) in different months generally showed similar trends both in the small (less than 27.5 cm total length) and large (more than 27.5 cm total length) catfish. The relative importance of various food items during different months shows that feeding is selective.

82-002560 Nair, K. V. S. FOOD AND FEEDING HABITS OF *OTOLITHES RUBER* (SCHNEIDER) AT CALICUT. *Indian J. Fish.* 26(1-2):133-139. 1979. SFA 27(4)
[Calicut Res. Cent., Cent. Mar. Fish. Res. Inst., Calicut, India]

82-002561 Nesterov, A. A. THE FEEDING OF *SCOMBRESOX SAURUS* (SCOMBERESOCIDAE) AND ITS TROPHIC RELATIONSHIPS IN THE EPIPELAGIC ZONE OF THE OCEAN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):55-69. 1981. SFA 27(4)
[AtlantNIRO, Kalinigrad, USSR]

82-002562 Oijen, M. J. P. van. ECOLOGICAL DIFFERENTIATION AMONG THE PISCIVOROUS HAPLOCHROMINE CICHLIDS OF LAKE VICTORIA (EAST AFRICA). *Neth. J. Zool.* 32(3):336-363. 1982. SFA 27(4)
[Rijksmus. Nat. Hist., P.O. Box 9517, 2300 RA, Leiden, Netherlands]

FOODS/FEEDING (CONTINUED)

82-002563 Peterson, R. H. and D. J. Martin-Robichaud. FOOD HABITS OF FISHES IN TEN NEW BRUNSWICK LAKES. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 1094. iii + 43p. Apr. 1982. In English with French summ. SFA 27(4)
[Biol. Stn., St. Andrews, NB E0G 2X0, Canada] The analyses of the stomach contents of 23 species of fish from 10 N.B. lakes are presented, using percent occurrence and relative volumetric importance as parameters. Fish food habits were arrayed in a vector diagram such that food habits are related to trophic level. White suckers, banded killifish, ninespine sticklebacks, and juveniles of white perch and pumpkinseeds, ate mainly dipteran larvae and zooplankton. Brown bullheads, pumpkinseed, white perch, golden shiners, common shiners, and juvenile yellow perch ate dipteran larvae and larger aquatic invertebrates. Fallfish, creek chub, and lake chub relied primarily on larger aquatic insects. Brook trout, yellow perch, and smallmouth bass ate larger aquatic insects and fish. Chain pickerel fed on fish. Fish communities in the lakes are discussed with reference to water chemistry and susceptibility to potential lake acidification.

82-002564 Pirozhnikov, P. L. ZOOPLANKTON AND THE FEEDING OF PLANKTIVOROUS FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(1):54-64. 1981. SFA 27(4)
[GosNIORKh, Leningrad, USSR]

82-002565 Schmitt, R. J. and S. W. Strand. COOPERATIVE FORAGING BY YELLOWTAIL, *SERIOLA LALANDEI* (CARANGIDAE), ON TWO SPECIES OF FISH PREY. *Copeia* 1982(3):714-717. 10 Aug. 1982. SFA 27(4)
[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106]

82-002566 Schreiber, D. C. and W. L. Minckley. FEEDING INTERRELATIONS OF NATIVE FISHES IN A SONORAN DESERT STREAM. *Great Basin Nat.* 41(4):409-426. 31 Dec. 1981. SFA 27(4)
[Okla. Water Resour. Bd., Oklahoma City 73105] Native fishes in Aravaipa Creek, Arizona, cropped foods proportional to abundance of those foods within the system. Ephemeropteran nymphs and adults comprised the major prey of 5 to 7 fishes (*Gila robusta*, *Meda fulgida*, *Rhinichthys osculus*, *Tiaroga cobitis*, and *Catostomus insignis*). The omnivorous *Agosia chrysogaster* ate almost as many nymphal mayflies as did the carnivores. *Pantosteus clarki* was herbivorous, taking animals only when they were abundant. When ephemeropterans decreased in abundance, a shift by some fish species occurred to other locally or seasonally abundant items. Other fishes continued to feed upon the same foods throughout the year. Abundance of invertebrates in Aravaipa Creek, coupled with marked spatial partitioning of habitat by fishes present, seemingly precluded severe interspecific interactions for food.

82-002567 Smagula, C. M. and I. R. Adelman. DAY-TO-DAY VARIATION IN FOOD CONSUMPTION BY LARGEMOUTH BASS. *Trans. Am. Fish. Soc.* 111(5):543-548. Sept. 1982. SFA 27(4)
[I. R. Adelman: Dep. Entomol. Fish. Wildl., Univ. Minn., St. Paul 55108]

82-002568 Steimle, F. W., Jr. and L. Ogren. FOOD OF FISH COLLECTED ON ARTIFICIAL REEFS IN THE NEW YORK BIGHT AND OFF CHARLESTON, SOUTH CAROLINA. *Mar. Fish. Rev.* 44(6-7):49-52. June-July 1982. SFA 27(4)
[NMFS, Sandy Hook Lab., Highlands, NJ 07732] The construction of artificial reefs is a popular means of countering increasing recreational fishing pressure. Despite their popularity, many questions persist about their function and effectiveness as a mangement tool. This paper discusses the role of the epifauna, which developes on artificial reefs and most other submerged hard surfaces, in providing food for the fish population found on

FOODS/FEEDING (CONTINUED)

82-002568 CONTINUED or near artificial reefs. The stomach contents of 309 specimens of 13 species of fish, collected by spear or hook and line at three artificial reef sites, were examined to better define their trophic dependence on reef epifauna. Although most examined species did not appear to be highly dependent on the reef epifauna for food, there is a need for further study.

82-002569 Thorman, S. NICHE DYNAMICS AND RESOURCE PARTITIONING IN A FISH GUILD INHABITING A SHALLOW ESTUARY ON THE SWEDISH WEST COAST. *Oikos* 39(1):32-39. June 1982. In English with Russian summ. SFA 27(4)
[Dep. Zool., Univ. Uppsala, P.O. Box 561, S-75122, Uppsala, Sweden]

82-002570 Wallace, R. K., Jr. DIET OVERLAP AMONG INLAND SILVERSIDE (*MENIDIA BERYLLINA*), YOUNG-OF-THE-YEAR LARGEMOUTH BASS (*MICROPTERUS SALMOIDES*) AND JUVENILE BLUEGILL (*LEPOMIS MACROCHIRUS*). *Ph.D. dissertation, Auburn Univ.* 82p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(1):37. July 1982. SFA 27(4)
Inland silverside were found to be unsuitable for introduction as a prey species because of potential competition with largemouth bass for bluegill fry as well as for other food categories. Inland silverside also have the potential to reduce already established bluegill populations through food competition and predation.--From abstr.

82-002571 Weinstein, M. P.; K. L. Heck, Jr.; P. E. Giebel and J. E. Gates. THE ROLE OF HERBIVORY IN PINFISH (*LAGODON RHOMBOIDES*): A PRELIMINARY INVESTIGATION. *Bull. Mar. Sci.* 32(3):791-795. July 1982. SFA 27(4)
[Dep. Biol., Va. Commonwealth Univ., Richmond 23284]

82-002572 Wellington, G. M. DEPTH ZONATION OF CORALS IN THE GULF OF PANAMA: CONTROL AND FACILITATION BY RESIDENT REEF FISHES. *Ecol. Monogr.* 52(3):223-241. Sept. 1982. SFA 27(4)
[Mar. Sci. Inst., Univ. Calif., Santa Barbara 93106]

82-002573 Wright, D. I. and W. J. O'Brien. DIFFERENTIAL LOCATION OF *CHAOBORUS* LARVAE AND DAPHNIA BY FISH: THE IMPORTANCE OF MOTION AND VISIBLE SIZE. *Am. Midl. Nat.* 108(1):68-73. July 1982. SFA 27(4)
[Limnol. Res. Cent., 220 Pillsbury Hall, Univ. Minn., Minneapolis 55455]
The distance at which white crappie (*Pomoxis annularis*) could locate *Chaoborus* larvae (*C. americanus* and *C. punctipennis*) and *Daphnia magna* was measured. This "reactive distance" increased as a linear function of prey size for both prey types. Prey motion more than doubled the maximum distance at which *Chaoborus* larvae could be located. Significant reactive distance changes also occurred as the orientation of *Chaoborus* to the predator varied. The reactive distance to body-length relations of *Chaoborus* and *D. magna* differed and indicated that *Chaoborus* were less visible than *Daphnia*.

82-002574 Yáñez-Arancibia, A. and G. Díaz-González. ECOLOGÍA TROFODINÁMICA DE *DORMITATOR LATIFRONS* (RICHARDSON) EN NUEVE LAGUNAS COSTERAS DEL PACÍFICO DE MÉXICO. (PISCES: ELEOTRIDAE). [TROPHIC-DYNAMIC ECOLOGY OF *DORMITATOR LATIFRONS* (RICHARDSON) IN NINE COASTAL LAGOONS ON THE PACIFIC COAST OF MÉXICO. (PISCES: ELEOTRIDAE).] An. Cent. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex. 4(1):125-140. 1977. In Spanish with English summ. SFA 27(4)
[Cent. Cienc. Mar. Limnol., Univ. Nac. Auton. Mex., Cuidad Univ., Mexico 20, D.F.]

FOODS/FEEDING (CONTINUED)

82-002575 Yap, Y. S. and J. I. Furtado. THE FEEDING ECOLOGY OF *CYCLOCHEILICHTHYS APOGON* VALENCIENNES (CYPRINIDAE) IN SUBANG RESERVOIR; MALAYSIA. *Trop. Ecol.* 22(2):194-203. 1981. SFA 27(4)
[Dep. Zool., Univ. Malaya, Kuala Lumpur, Malaysia]

AGE AND GROWTH

82-002576 Allen, J. R. M. and R. J. Wootton. AGE, GROWTH AND RATE OF FOOD CONSUMPTION IN AN UPLAND POPULATION OF THE THREE-SPINED STICKLEBACK, *GASTEROSTEUS ACULEATUS* L. *J. Fish Biol.* 21(1):95-105. July 1982. SFA 27(4)
[Dep. Zool., Univ. Coll. Wales, Aberystwyth, Dyfed, Wales] In a population of *Gasterosteus aculeatus* living in an infertile, upland lake, the fish bred at the age of one year and few survived to breed again. The highest growth rates were achieved in the first month of life, but in comparison with other populations of *G. aculeatus* growth was slow during the autumn and ceased during the winter. But in spring and early summer, there was a spurt in the growth rate. Laboratory studies provided regression models for the prediction of the rate of food consumption from measurements of growth. The estimates of the consumption rate indicated the effect of the growth in body size and seasonal variations during the first year of life. It was estimated that a fish of mean length in the population consumed 3150 mg of food in a year in which it grew from 65.8 to 552.0 mg, with an overall gross growth effciency of 15.4%. The study illustrated the integration of laboratory and field studies to obtain reasonable estimates of the rate of food consumption by fish throughout their first year of life.

82-002577 Appukuttan, K. K.; P. N. Radhakrishnan Nair and K. K. Kunhikoya. STUDIES ON THE FISHERY AND GROWTH RATE OF OCEANIC SKIPJACK *KATSUWONUS PELAMIS* (LINNAEUS) AT MINICOY ISLAND FROM 1966 TO 1969. *Indian J. Fish.* 24(1-2):33-47. 1977. SFA 27(4)

82-002578 Campana, S. E. and J. D. Neilson. DAILY GROWTH INCREMENTS IN OTOLITHS OF STARRY FLOUNDER (*PLATICHTHYS STELLATUS*) AND THE INFLUENCE OF SOME ENVIRONMENTAL VARIABLES IN THEIR PRODUCTION. *Can. J. Fish. Aquatic Sci.* 39(7):937-942. July 1982. In English with French summ. SFA 27(4)
[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

82-002579 Chang, W. Y. B. A STATISTICAL METHOD FOR EVALUATING THE REPRODUCIBILITY OF AGE DETERMINATION. *Can. J. Fish. Aquatic Sci.* 39(8):1208-1210. Aug. 1982. In English with French summ. SFA 27(4)
[Great Lakes Res. Div., Univ. Mich., Ann Arbor 48109]

82-002580 Clay, D. and H. Clay. BACK-CALCULATED AGE AND GROWTH OF THE CATFISH, *CLARIAS LAZERA*, IN ISRAEL. *Isr. J. Zool.* 30(1-2):16-21. 1981. SFA 27(4)
[Bedford Inst. Oceanogr., Dartmouth, NS B2Y 4A2, Canada] Age and growth of *Clarias lazera* from Israel (near 'En haMifraz) were back-calculated from vertebrae using the direct proportion method. No sexual dichotomy was found in growth. The von Bertalanffy growth equation for back-calculated lengths-at-age was $TL=338.38\ [1-e^{-0.028(t+1.33)}]$, ($n=154, r^2=0.97$). The growth rate for these fish falls within the range of the same genus from similar environments in the Middle East and Africa.

AGE AND GROWTH (CONTINUED)

82-002581 Dan, S. S. and P. Mojumder. LENGTH-WEIGHT RELATIONSHIP IN CATFISH *TACHYSURUS TENUISPINIS* (DAY). *Indian J. Fish.* 25(1-2):23-28. 1978. SFA 27(4)

82-002582 De León, M. E. and A. Malkov. ESTUDIO PRELIMINAR DE LA EDAD Y CRECIMIENTO DEL *BERYX SPLENDENS*, LOWE DEL ATLÁNTICO CENTRO-OCCIDENTAL. [PRELIMINARY STUDIES ON THE AGE AND GROWTH OF *BERYX SPLENDENS*, LOWE OF THE WEST CENTRAL ATLANTIC.] Rev. Cubana Invest. Pesq. 4(4):62-73. 1979. In Spanish with English summ. SFA 27(4)
[Cent. Invest. Pesq., Miramar, Havana, Cuba]

82-002583 Dhulkhed, M. K. DETERMINATION OF MEAN LENGTH OF OILSARDINE AT DIFFERENT AGES BASED ON THE ANNUAL SIZE-FREQUENCY DISTRIBUTION. *Indian J. Fish.* 24(1-2):195-198. 1977. SFA 27(4)

82-002584 Dirin-Khalturin, D. K. CUASES OF SIZE-AGE DIFFERENCES IN YOUNG SALMON AND SPAWNERS (SALMONIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(4):64-80. 1981. SFA 27(4)
[Zool. Inst., USSR Acad. Sci., Leningrad, USSR] Anaylsis of the size-weight indices and age of juveniles, smolts and adult salmon (family Salmonidae) in nature, reveals patterns of the direct and inverse relationship of these parameters during the two main periods of life. Frequently, the original cause of the differences investigated proves to be the temperature regime in the reproductive waters, reflected in other features of the environment, and also feeding conditions. The basic variability in the weight and age of young salmon and spawner-migrants casts doubt on the notion of a uniform environment for uncubation of eggs and larvae and overwintering of young, particularly in regard to cold-water species. The results of an analysis of the natural variability of salmon have significance for their culture.

82-002585 Foucher, R. P. and D. Fournier. DERIVATION OF PACIFIC COD AGE COMPOSITION USING LENGTH-FREQUENCY ANALYSIS. *N. Am. J. Fish. Manage.* 2(3):276-284. 1982. SFA 27(4)
[Dep. Fish. Oceans, Resour. Serv. Br., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

82-002586 Frie, R. V. MEASUREMENT OF FISH SCALES AND BACK-CALCULATION OF BODY LENGTHS USING A DIGITIZING PAD AND MICROCOMPUTER. *Fisheries (Bull. Am. Fish. Soc.)* 7(5):5-8. Sept.-Oct. 1982. SFA 27(4)
[Dep. Entomol. Fish. Wildl., Univ. Minn., 219 Hodson Hall, 1980 Folwell Ave., St. Paul 55108]

82-002587 Gjøsæter, H. and S. Tilseth. PRIMARY GROWTH INCREMENTS IN OTOLITHS OF COD LARVAE (*GADUS MORHUA* L.) OF THE ARCTO-NORWEGIAN COD STOCK. *Fiskeridir. Skr. Ser. Havunders.* 17(7):287-295. 1982. SFA 27(4)
[Inst. Mar. Res., Dir. Fish., Bergen, Norway]

82-002588 Guzmán-Arroyo, M.; J. L. Rojas-Galaviz and F. Vera-Herrera. CRECIMIENTO Y ASPECTOS POBLACIONALES DE LA LOBINA NEGRA *MICROPTERUS SALMOIDES* LACÉPÈDE EN EL LAGO DE CAMÉCUARO MICHOACÁN (PISCES: CENTRARCHIDAE). [GROWTH AND OTHER POPULATION ASPECTS OF *MICROPTERUS SALMOIDES* LACÉPÈDE IN THE LAKE OF CAMECUARO MICHOACÁN. (PISCES: CENTRARCHIDAE).] *An. Cent. Cienc.*

AGE AND GROWTH (CONTINUED)

82-002588 CONTINUED *Mar. Limnol. Univ. Nac. Auton. Mex.* 6(1):53-68. 1979. SFA 27(4)

[Lab. Limnol. Acuicult., Univ. Nac. Auton. Mex., Mexico D.F.] In December 1971 a sample of largemouth black bass *Micropterus salmoides* Lacépede was collected from Camecuaro Lake, State of Michoacan. On the basis of the biometric data, graphs of distribution of frequencies for standard length and total weight were made. The relation established between length and weight was: log. W=6.0252-3.5572 log. L y $W=.000000943\ L^{3.5572}$. By means of analysis the age and annual growth were determined. Each ring was compared with fish length and the following relation was determined: Lp=3.752711 Le-3.544307; determining the composition of size for each age group. In order to develop the Von Bertalanffy model the constants $e-K=e-^{.5631}$ were obtained; maximum theoretical standard length L∞=358.4 mm; maximum theoretical total weight $W\infty^{33}=1151.3$ g; average theoretical time of growth commencement T.=-0.803. With the data cited above the growth curve was fitted in the following manner: total weight $Wt=1151.3\ [I-e-^{.5631(T+_{0.803})}]$, standard length $Lp=358.4\ [I-e-^{.5631(T+_{0.803})}]^{3.55}$. With the values obtained from the curve the instantaneous growth rate and the specific growth rhythm for length and weight were calculated. Also, the instantaneous survival rate ($S=.2$, $e^{-Z}=e-^{1.609}$) and the instantaneous mortality rate (Z=1.609.) were determined. The maximum growth rate was registered between 2 and 3 years of age. The condition factor (K) was calculated for the values observed and theorically in relation to sex and age. The use of Q (mulitple of 10) is proposed as a constant in order to facilitate the calculation of the condition factor and the instantaneous increment rate.

82-002589 Harmin, S. A. THE INFLUENCE OF SELECTED WATER QUALITY PARAMETERS ON THE GROWTH OF FISH IN TOBACCO JUICE CREEK. *MS thesis, Miss. State Univ.* 39p. 1979. From Miss. State Univ. Library Publ. No. 19. p. 375. 1981. Abstract only. SFA 27(4)

The physico-chemical parameters of a small warm-water stream were investigated over a period of ten months. Water parameters investigated were dissolved oxygen, water temperature, total alkalinity, carbon dioxide, pH and turbidity. Total alkalinity was higher in summer than in winter. A mark-recapture study for evaluation of the growth of several fish species were made. Length and weight gain were regressed on water quality parameters. Simple linear regression was used for this purpose. Dissolved oxygen and water temperature were significantly ($\alpha=0.05$) correlated with fish growth. Total alkalinity, carbon dioxide, pH and turbidity were not significantly ($\alpha-0.05$) correlated with fish growth. In general, fish growth was poor. The nature of the stream was partially responsible for its low productivity as was exemplified by physico-chemical parameters of the stream. Critical values of dissolved oxygen occurred in summer and early fall. Dissolved oxygen probably affected the growth of fish during the time.

82-002590 Jobling, M. FOOD AND GROWTH RELATIONSHIPS OF THE COD, *GADUS MORHUA* L., WITH SPECIAL REFERENCE TO BALSFJORDEN, NORTH NORWAY. *J. Fish Biol.* 21(4):357-371. Oct. 1982. SFA 27(4)

[Inst. Fiskerifag, Univ. Tromsø, 9001 Tromsø, Norway] Rates of food consumption are notoriously difficult to measure under field conditions and indirect methods must be used. Using data for cod collected from three different areas (North Sea, Faroes & Balsfjorden), food consumption was estimated from stomach fullness and rates of gastric evacuation. These estimates were then compared with estimates given by analysis of food-growth relationships. Although estimates were of the same order of magnitude there were differences. These differences were suggested to be largely due to insufficient knowledge relating to feeding rhythms of wild fish and lack of

AGE AND GROWTH (CONTINUED)

82-002590 CONTINUED data regarding the 'costs of reproduction'. Differences between the annual energy budgets of cod from the three stocks are discussed.

82-002591 Krishnamurthy, K. N. and M. Kaliyamurthy. STUDIES ON THE AGE AND GROWTH OF SANDWHITING *SILLAGO SIHAMA* (FORSKAL) FROM PULICAT LAKE WITH OBSERVATIONS ON ITS BIOLOGY AND FISHERY. *Indian J. Fish.* 25(1-2):84-97. 1978. SFA 27(4)

82-002592 Laroche, J. L.; S. L. Richardson and A. A. Rosenberg. AGE AND GROWTH OF A PLEURONECTID, *PAROPHRYS VETULUS*, DURING THE PELAGIC LARVAL PERIOD IN OREGON COASTAL WATERS. *NOAA Fish. Bull.* 80(1):93-104. Jan. 1982. SFA 27(4)

[Gulf Coast Res. Lab., East Beach Dr., Ocean Springs, MS 39564] The age of 331 field-collected English sole, *Parophrys vetulus*, larvae, 3.1-20.0 mm SL, was determined using daily otolith growth increments. Age in days from hatching was estimated by adding 5, the number of days prior to first increment formation in the laboratory, to the number of increments counted on sagittae. Number of otolith growth increments among larvae of known age in the laboratory ranged widely. Yet daily periodicity of increment formation in *P. vetulus* was inferred from the observations that even under poor growing conditions some larvae added one increment each day since first formation and that, unlike the remaining laboratory-reared larvae in which no pattern was evident, increment addition among larvae in the sea appeared to follow a stable and uniform pattern. Gompertz and von Bertalanffy growth models fitted the resultant size-at-age data equally well; therefore, only the Gompertz model is presented. Larval growth rate decreased from 0.3 mm per day at 8-9 days of age to <0.1 mm per day between 73 and 74 days. The oldest specimen was 74 days old, but most of the larval and transforming specimens collected in plankton samples were <70 days old. Previous estimates of age at length of larval *P. vetulus*, based on length-frequency modal progresion analysis, overestimated the age of larvae >5.5 mm SL by 2-3 times and, correspondingly, the duration of pelagic life was overestimated, 18-20 weeks compared to 8-10 weeks based on otolith-estimated age.

82-002593 Mel'nikov, Y. S. SIZE-AGE COMPOSITION AND GROWTH PATTERN OF *ALLOCYTTUS VERRUCOSUS* (OREOSOMATIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):178-184. 1981. SFA 27(4)

[AzCherNIRO, Kerch, USSR]

82-002594 Mojumder, P. LENGTH-FREQUENCY STUDIES ON CATFISH *TACHYSURUS THALASSINUS* AT WALTAIR DURING 1964-1970. *Indian J. Fish.* 24(1-2):90-95. 1977. SFA 27(4)

Determination of age and growth of the catfish *Tachysurus thalassinus* (Ruppell) has been attempted employing length-frequency method, during the years 1964-65 to 69-70. The fish is found to attain an average length of 18 cm at the end of its first year, 35 cm at the end of 2nd year and 42 cm at the end of 3rd year. The fishery along the Visakhapatnam coast is supported mainly by those which have completed one year. The spawning season starts around April and continues up till July or August, and the young-ones start entering the fishery from November-December.

82-002595 Neilson, J. D. and G. H. Geen. OTOLITHS OF CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*): DAILY GROWTH INCREMENTS AND FACTORS INFLUENCING THEIR PRODUCTION. *Can. J. Fish. Aquatic Sci.*

AGE AND GROWTH (CONTINUED)

82-002595 CONTINUED 39(10):1340-1347. Oct. 1982. In English with French summ. SFA 27(4)
[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada]

82-002596 Penczak, T.; M. Zalewski; E. Suszycka and M. Moliński. ESTIMATION OF THE DENSITY, BIOMASS AND GROWTH RATE OF FISH POPULATIONS IN TWO SMALL LOWLAND RIVERS. *Ekol. Pol.* 29(2):233-255. 1982. In English with Polish summ. SFA 27(4)
[Dep. Comp. Anat. Anim. Ecol., Inst. Environ. Biol., Univ. Lodz, Banacha 12/16,90-237 Lodz, Poland]

82-002597 Prasad, S.; D. P. Sinha; A. K. Chanchal and B. N. Pandey. A BIOMETRIC STUDY OF SOME ASPECTS OF THE BIOLOGY OF *MACROGNATHUS ACULEATUM*. (PISCES: MASTACEMBELIDAE). *An. Cent. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex.* 6(2):59-66. 1979. In English with Spanish summ. SFA 27(4)
[Magadh Univ., Dep. Zool., Bodh Gaya 824234, Bihar, India]

82-002598 Quinn, S. P. and M. R. Ross. ANNULUS FORMATION BY WHITE SUCKERS AND THE RELIABILITY OF PECTORAL FIN RAYS FOR AGEING THEM. *N. Am. J. Fish. Manage.* 2(2):204-208. 1982. SFA 27(4)
[Dep. For. Wildl. Manage., Univ. Mass., Amherst 01003]

82-002599 Rengaswamy, V. S. STUDIES ON LENGTH FREQUENCY OF OILSARDINE AT CALICUT DURING 1970-71 TO 73-74. *Indian J. Fish.* 24(1-2):69-75. 1977. SFA 27(4)

82-002600 Reynolds, L. F. and R. Moore. GROWTH RATES OF BARRAMUNDI, *LATES CALCARIFER* (BLOCH), IN PAPUA NEW GUINEA. *Aust. J. Mar. Freshwater Res.* 33(4):663-670. 1982. SFA 27(4)
[New South Wales State Fish., P.O. Box N211, Grosvenor St., Sydney, N.S.W. 2000, Australia] Growth rates of *L. calcarifer* in western Papua were determined using modal progression in length-frequency samples and analysis of increases in lengths of tagged fish. Growth was rapid, the Von Bertalanffy parameters being K=0.128, L_∞=138 cm and t_0=-1.12 years. The length-weight relationships was W=0.0106$l^{3.02}$, were W is weight measured in grams and l is length measured in centimetres.

82-002601 Rosenberg, A. A. and J. L. Laroche. GROWTH DURING METAMORPHOSIS OF ENGLISH SOLE, *PAROPHRYS VETULUS*. *NOAA Fish. Bull.* 80(1):150-153. Jan. 1982. SFA 27(4)
[Dep. Oceanogr., Dalhousie Univ., Halifax, NS B3H 3J5, Canada]

82-002602 Ross, J. L. and G. R. Huntsman. AGE, GROWTH, AND MORTALITY OF BLUELINE TILEFISH FROM NORTH CAROLINA AND SOUTH CAROLINA. *Trans. Am. Fish. Soc.* 111(5):585-592. Sept. 1982. SFA 27(4)
[N.C. Div. Mar. Fish., Monteo 27954]

82-002603 Rubec, P. J. and S. U. Qadri. COMPARATIVE AGE, GROWTH, AND CONDITION OF BROWN BULLHEAD, *ICTALURUS NEBULOSUS*, IN SECTIONS OF THE OTTAWA RIVER, CANADA. *Can. Field-Nat.* 96(1):6-18. Jan.-Mar. 1982. SFA

AGE AND GROWTH (CONTINUED)

82-002603 CONTINUED 27(4)
[Biol. Sci. Cent., Boston Univ., Boston, MA 02215] The abundance, age, growth and condition of six populations of Brown Bullhead, *Ictalurus nebulosus* from the three sections of the Ottawa River have been compared. Gill netting indicated bullheads were more abundant below industrial and municipal effluents. The species was most abundant and formed a larger percentage of the catch of all species below Hawkesbury. Significantly slower growth and poorer condition of brown bullhead were found at stations in the lotic lower river section, below Ottawa, were wood-fiber blankets much of the substrate. Better growth and condition of bullheads occurred in the lake-like Hawkesbury and upper river sections where wood-fiber is scarce or absent. Growth in length appeared related to physical conditions applicable to an entire section of river, rather than to localized factors at stations below industrial and municipal effluents. Previous age and growth estimates from pectoral spines have generally underestimated age by one year and hence seriously overestimated growth at "age I".

82-002604 Saleh, U. B. DEVELOPMENT OF SIZE RANKING IN SIBLING CHANNEL CATFISH FINGERLINGS. *MS thesis, Miss. State Univ.* 54p. 1979. From Miss. State Univ. Library Publ. No. 19. p. 379-380. 1981. Abstract only. SFA 27(4)
A total of 3600 sibling channel catfish fry (*Ictalurus punctatus*) in 12 equally divided groups were used to determine the development of size ranking in 4 different size of channel catfish. The sex ratio of channel catfish was found to be 1 to 1. More males than females were present in high class size. Sex ratios of 1 to 0.85, 1 to 0.93, 1 to 1.12 and 1 to 0.85 were obtained for size class 1 (15 cm and above), size class 2(13.5 to 14.9 cm), size class 3(12.0 to 13.4 cm) and size class 4(less than 12.0 cm) respectively. While sex ratios of branded fish (size class 1) were 1 to 1.35, 1 to 0.43 and 1 to 0.77 for groups A, B and C respectively. Sex ratio between and within the groups of branded fish were significantly different ($P \leq 0.01$). After the fish were grown for 180 days (second phase) the groups remained discrete with no overlapping either in length or weight. Growth rates of males and females were significantly different ($P \leq 0.01$). It was found that male channel catfish fingerlings grow faster than female. Males were the heaviest individuals in population. Stress conditions created in the tanks caused low survival rate (24.08 percent) of a week-old fry at the end of phase 1 (125 days) of growing period.

82-002605 Seshappa, G. SOME OBSERVATIONS ON THE SIZE DISTRIBUTION AND THE OCCURRENCE OF GROWTH RINGS IN THE SCALES OF THREE SPECIES OF *CYNOGLOSSUS* AT CALICUT. *Indian J. Fish.* 25(1-2):188-196. 1978. SFA 27(4)

82-002606 Shubina, L. I. GROWTH AND SEXUAL MATURATION OF THE CASPIAN SHAD, *ALOSA CASPIA CASPIA. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):98-108. 1981. SFA 27(4)
[KaspNIRKh, Astrakhan, USSR] Patterns of population growth rates in the Caspian shad, *Alosa caspia caspia*, are given and also the growth of individual year-classes. A decrease in the rate of growth and an acceleration in the sexual maturation of the shad have been noted in recent years; the reasons for these phenomena are discussed.

82-002607 Sonina, M. A. GROWTH RATE AND SEXUAL MATURATION OF THE HADDOCK, *MELANOGRAMMUS AEGLEFINUS. J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):85-97. 1981. SFA 27(4)
[PINRO, Murmansk, USSR] The growth rate of haddock, *Melanogrammus aeglefinus*, of different year-classes and during 1930-1937, 1952-1964, 1965-1978 was studied. With improvement in food supply, growth rates of the

AGE AND GROWTH (CONTINUED)

82-002607 CONTINUED Barents Sea haddock gradually increased from the 1930's to the 1970's. As a result sexual maturation was speeded up between the 1950's and the 1970's, leading to rejuvenation of the population.

82-002608 Sukhanov, V. V. THE RELATIONSHIP BETWEEN FEEDING CONDITIONS AND GROWTH VARIABILITY IN ANIMALS. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):70-74. 1981. SFA 27(4)
[Pac. Inst. Geogr., Far East Sci. Cent., USSR Acad. Sci., Vladivostok, USSR]

82-002609 Victor, A. C. C. LENGTH-WEIGHT RELATIONSHIP IN THE MALABAR SOLE, *CYNOGLOSSUS MACROSTOMUS* NORMAN. *Indian J. Fish.* 25(1-2):259-262. 1978. SFA 27(4)

82-002610 Wilson, K. H. and P. A. Larkin. RELATIONSHIP BETWEEN THICKNESS OF DAILY GROWTH INCREMENTS IN SAGITTAE AND CHANGE IN BODY WEIGHT OF SOCKEYE SALMON (*ONCORHYNCHUS NERKA*) FRY. *Can. J. Fish. Aquatic Sci.* 39(10):1335-1339. Oct. 1982. In English with French summ. SFA 27(4)
[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

82-002611 Yohannan, T. M. THE GROWTH PATTERN OF INDIAN MACKEREL. *Indian J. Fish.* 26(1-2):207-216. 1979. SFA 27(4)
[Calicut Res. Cent., C.M.F.R. Inst., Calicut, India]

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC.

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[Cent. Cienc. Mar. Limnol., Univ. Nac. Auton. Mex., Cuidad Univ., Mexico 20, D.F.]

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[Ichthyological Assoc., Inc., 100 South Cass St., Middletown, DE 19709]

82-002618 Brunson, K. LITTLE FISH. *Kans. Wildl.* 39(4):11-22. July-Aug. 1982. SFA 27(4)

82-002619 Bullock, L. H. and M. F. Godcharles. RANGE EXTENSIONS FOR FOUR SEA BASSES (PISCES: SERRANIDAE) FROM THE EASTERN GULF OF MEXICO WITH A COLOR NOTE ON *HEMANTHIAS LEPTUS* (GINSBURG). *Northeast Gulf Sci.* 5(2):53-56. July 1982. SFA 27(4)
[Mar. Res. Lab., 100 Eighth Ave., SE, St. Petersburg, FL 33701]

82-002620 Dumont, P. DISPERSION POST-GLACIAIRE DEL L'OMBLE CHEVALIER D'EAU DOUCE (*SALVELINUS ALPINUS*) DANS LE QUÉBEC MÉRIDIONAL. [POST-GLACIAL DISPERSION OF THE ARCTIC CHARR (*SALVELINUS ALPINUS*) IN SOUTHERN QUEBEC.] *Nat. Can. (Que.)* 109(2):229-234. Sept. 1982. In French with English summ. SFA 27(4)
[Serv. Amenage. Exploitation Faune, Minist. Loisir, Chas. Pêche Que., 13 rue Buteau, Hull, PQ J8Z IV4, Canada] The known distribution of arctic charr in southern Québec is limited to less than a hundred lakes; most of them are of small area. These populations are probably vestiges of the anadromous populations which lived in the Champlain sea and the Atlantic ocean, approximately 11,900 years ago. Their dispersion would have taken place during the first phases of the marine invasion that followed the retreat of the glaciers. Ecological factors (changes in the environment, interspecific competition) have contributed to the restriction of its distribution. Because of human intervention (introduction of competing species, pollution), the species can be considered marginal in its existence or even completely eradicated in many of the water bodies where its presence had once been recorded.

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GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

82-002622 CONTINUED

[Ky. Nat. Preserves Comm., Frankfort 40601] Recent collecting efforts and examination of museum material resulted in a reassessment of the distribution of *Etheostoma atripinne* in Kentucky and contributed to the understanding of its habitat preferences. The range of *E. atripinne* as now defined is continuous from Fishing Creek, Pulaski County, Kentucky, downstream in the Cumberland River of Tennessee to Little River, Trigg County, Kentucky. *Etheostoma atripinne* was taken primarily from cobble-pebble riffles in streams ranging from third to fifth order. Gradients ranged from 0.7-3.2 m/km with velocities of 0.098-0.690 m/s. Water quality analyses indicated that *E. atripinne* inhabits well-buffered, hardwater streams with little or no siltation.

82-002623 Flores-Coto, C. and J. Alvárez. Cadena. ESTUDIOS PRELIMINARES DE DISTRIBUCIÓN Y ABUNDANCIA DEL ICTIOPLANCTON EN LA LAGUNA DE TÉRMINOS, CAMPECHE. [PRELIMINARY STUDIES ON ABUNDANCE AND DISTRIBUTION OF ICHTHYOPLANKTON IN TERMINOS LAGOON, CAMPECHE.] *An. Cent. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex.* 7(2):67-78. 1980. In Spanish with English summ. SFA 27(4)

[Cent. Cienc. Mar. Limnol., Univ. Nac. Auton. Mex., Ciudad Univ., Mexico 20, D.F.]

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[Ark. Game Fish Comm., 2 Nat. Resour. Dr., Little Rock 72205]

82-002625 Getter, C. D. TEMPERATURE LIMITATIONS TO THE DISTRIBUTION OF MANGROVE MOSQUITOFISH IN FLORIDA. *Fla. Sci.* 45(3):196-200. 1982. SFA 27(4)

[Res. Plan. Inst., Inc., 925 Gervais St., Columbia, SC 29201] An extensive survey of southern Florida revealed a limited, coastal distribution of the mangrove mosquitofish (*Gambusia rhizophorae*). However, discovery of the species in collections from Cuban fresh waters indicates that it is not salinity-limited. Laboratory studies determined the low-temperature tolerance of the species to be 17°C. The winter, low-temperature isotherm for southern Florida at this temperature intersects all furthest-known points north and west of the species' distribution. Temperature limitations to distribution may be controlled by fertility which, for the mangrove mosquitofish, is known to be correlated with temperature.

82-002626 Gibson, D. W. RANGE EXTENSION OF THE THREESPINE STICKLEBACK, *GASTEROSTEUS ACULEATUS*, TO MANITOULIN ISLAND, ONTARIO. *Can. Field-Nat.* 96(1):86. Jan.-Mar. 1982. SFA 27(4)

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82-002627 Gilhen, J. and D. E. McAllister. FIRST CANADIAN RECORD OF YELLOWFIN BASS, *ANTHIAS NICHOLSI* FIRTH, TAKEN OFF NOVA SCOTIA. *Proc. N.S. Inst. Sci.* 31(3-4):251-254. June 1982. SFA 27(4)

[N.S. Mus. 1747 Summer St., Halifax, NS B3H 3A6, Canada]

82-002628 Heald, D. I. and M. H. Walker. 'TAIYO MARU 71' DEMERSAL TRAWLING CRUISE IN WESTERN AUSTRALIAN COASTAL WATERS SOUTH OF 21° S, JULY-SEPTEMBER, 1979. *West. Aust. Dep. Fish. Wildl. Rep.* No. 51. 104p. 1982. SFA 27(4)

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

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82-002632 Kepner, W. G. AQUATIC INVENTORY OF THE BILL WILLIAMS AND HASSAYAMPA DRAINAGES, MARICOPA, YAVAPAI, AND YUMA COUNTIES, ARIZONA. *U.S. Dep. Interior Bur. Land Manage. Tech. Note* No. 354. 65p. 1980. Available from U.S. Bur. Land Manage., Denver Serv. Cent., Fed. Bldg. 50, Denver, CO 80225. SFA 27(4)

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[Lab. Rybárstva Hydrobiol., Drieňová 3, 826 24 Bratislava, Czechoslovakia]

82-002634 Krishna Pillai, S. and A. A. Jayaprakash. OCCURRENCE OF JUVENILES OF THE INDIAN MACKEREL *RASTRELLIGER KANAGURTA* (CUVIER) IN BOMBAY WATERS. *Indian J. Fish.* 25(1-2):257-259. 1978. SFA 27(4)

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82-002636 Linder, A. D. *PTYCHOCHEILUS* (SQUAWFISH) FROM PLEISTOCENE AMERICAN FALLS LAKE. *J. Idaho Acad. Sci.* 17(2):51-54. Dec. 1981. SFA 27(4)
[Dep. Biol., Idaho State Univ., Pocatello 83201] A partial skeleton of a squawfish of the genus *Ptychocheilus* has been recovered from deposits of the Pleistocene (probably Sangamonian), contributing to the intriguing distribution pattern of the fishes of the upper Snake River in Idaho. This fossil casts some doubt on the hypothesis of Hubbs and Miller which accounts for the absence of downstream species in the upper river by proposing that

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

82-002636 CONTINUED Miocene lava flows over wide areas of southern Idaho obliterated the upper Snake River fauna when or after the falls on the Snake River were formed.

82-002637 Mead, J. I.; R. S. Thompson and T. R. Van Devender. LATE WISCONSINAN AND HOLOCENE FAUNA FROM SMITH CREEK CANYON, SNAKE RANGE, NEVADA. *Trans. San Diego Soc. Nat. Hist.* 20(1):1-16. 6 Aug. 1982. SFA 27(4)
[Lab. Paleoenviron. Stud., Dep. Geosci., Univ. Ariz., Tucson 85721]

82-002638 Mohsin, A. K. M. and M. A. Ambak. CYPRINOID FISHES OF THE SUBFAMILY CYPRININAE IN SELANGOR. *Malay. Nat. J.* 35(1-2):29-55. Mar. 1982. SFA 27(4)
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82-002639 Moyle, P. B.; J. J. Smith; R. A. Daniels; T. L. Taylor; D. G. Price and D. M. Baltz. DISTRIBUTION AND ECOLOGY OF STREAM FISHES OF THE SACRAMENTO-SAN JOAQUIN DRAINAGE SYSTEM, CALIFORNIA. *Univ. Calif. Publ. Zool.* 115:1-256. Jan. 1982. SFA 27(4)

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82-002643 Pillai, S. K. and V. S. Somvanshi. A NEW RECORD OF THE GRUB FISH, *PARAPERCIS ALBOGUTTA* (GUNTHER) FROM BOMBAY WATERS. *Indian J. Fish.* 26(1-2):237-238. 1979. SFA 27(4)
[C.M.F.R.I. Res. Cent., Bombay, India]

82-002644 Pillai, S. K. ON OCCURRENCE OF MACKEREL, *RASTRELLIGER KANAGURTA* (CUVIER) IN DISTANT WATERS OFF BOMBAY. *Indian J. Fish.* 26(1-2):225-226. 1979. SFA 27(4)
[Bombay Res. Cent., C.M.F.R. Inst., Bombay, India]

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[Lab. Embryol. Genet., Fac. Fish., Hokkaido Univ., Hokodate, Japan]

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82-002647 Sewell, S. A. PRELIMINARY REPORT ON THE FISHES OF THE UPPER SALINE RIVER, POLK AND HOWARD COUNTIES, ARKANSAS, AND OBSERVATIONS ON THEIR RELATIONSHIPS WITH LAND USE AND PHYSIOCHEMICAL CONDITIONS. *Proc. Ark. Acad. Sci.* 35:60-65. 1981. SFA 27(4)
[U.S. Soil Conserv. Serv., Water Resour. Staff, Nashville, TN 37203]

82-002648 Shefler, D. and A. Ben-Tuvia. THE OCCURENCE OF GIBEL-CARP GOLDFISH, *CARASSIUS AURATUS GIBELIO*, IN LAKE KINNERET (LAKE TIBERIAS). *Bamidgeh* 34(2):63-65. June 1982. SFA 27(4)
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82-002649 Sokolovskiy, A. S. and T. G. Sokolovskaya. SPECIES COMPOSITION OF THE FAMILY ASTRONESTHIDAE (SALMONIFORMES) IN THE NORTH WEST PACIFIC. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(2):43-48. 1981. SFA 27(4)
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82-002651 Stevenson, D. K. A REVIEW OF THE MARINE RESOURCES OF THE WESTERN CENTRAL ATLANTIC FISHERIES COMMISSION (WECAFC) REGION. *FAO Fish. Tech. Pap.* No. 211. viii + 134p. 1981. SFA 27(4)
[Dep. Mar. Resour., Mar. Resour. Lab., West Boothbay Harbor, ME 04575]

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82-002653 Tweddle, D. THE FISHES OF THE MALAŴI NORTHERN REGION GAME RESERVES. *Nyala* 7(2):99-108. 1981. SFA 27(4)
[Fish. Dep., P.O. Box 111, Karonga, Malawi]

82-002654 Vigg, S. SPECIES COMPOSITION AND RELATIVE ABUNDANCE OF ADULT FISH IN PYRAMID LAKE, NEVADA. *Great Basin Nat.* 41(4):395-408. 31 Dec. 1981. SFA 27(4)
[Bioresour. Cent., Desert Res. Inst., Reno, NV 89506] Pyramid Lake fish populations were sampled with nets on a monthly basis from November 1975 through December 1977. Fish species were taken in the following order of numerical relative abundance: tui chub (*Gila bicolor*), Tahoe sucker (*Catostomus tahoensis*), Lahontan cutthroat trout (*Salmo clarki henshawi*) including cutthroat-rainbow hybrids, cui-ui (*Chasmistes cujus*), and Sacramento perch (*Archoplites interruptus*). Relative abundance estimates are discussed with respect to seasonal availability, spatial distribution of the fish, sampling bias of the fishing methods, and

GEOGRAPHICAL DISTRIBUTION, FISH SURVEYS, ETC. (CONTINUED)

82-002654 CONTINUED biomass of the fish.`Recent temporal trends in the population structure of the lake are presented.

82-002655 Walker, M. H.; S. J. Blight and G. M. Cliff. FEASIBILITY TRAWLING ACTIVITIES IN THE GREAT AUSTRALIAN BIGHT BY THE KOREAN TRAWLERS DONG BAND 91 AND DONG WON 509 DURING THE PERIOD 15.11.79 to 12.1.80. *West. Aust. Dep. Fish. Wildl. Rep.* No. 50. 59p. 1982. SFA 27(4)
[Dep. Fish Wildl., 108 Adelaide Terrace, Perth, Western Australia]

82-002656 Wooley, C. M.; P. A. Moon and E. J. Crateau. A LARVAL GULF OF MEXICO STURGEON (*ACIPENSER OXYRHYNCHUS DESOTOI*) FROM THE APALACHICOLA RIVER, FLORIDA. *Northeast Gulf Sci.* 5(2):57-58. July 1982. SFA 27(4)
[U.S. FWS, Off. Fish. Assistance, Panama City, FL 32405]

82-002657 Yáñez-Arancibia, A. TAXONOMÍA, ECOLOGÍA Y ESTRUCTURA DE LAS COMUNIDADES DE PECES EN LAGUNAS COSTERAS CON BOCAS EFÍMERAS DEL PACÍFICO DE MÉXICO. [TAXONOMY, ECOLOGY AND STRUCTURE OF FISH COMMUNITIES IN COASTAL LAGOONS WITH EPHEMERAL INLETS ON THE PACIFIC COAST OF MEXICO.] *Publ. Espec. Cent. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex.* 2:1-306. 1978. In Spanish with English summ. SFA 27(4)
[Univ. Nac. Auton. Mex., Ciudad Univ., Mexico 20, D.F.]

82-002658 Yáñez-Arancibia, L. A. ZOOGEOGRAFÍA DE LA FAUNA ICTIOLÓGICA DE LA ISLA DE PASCUA (EASTER ISLAND). [ZOOGEOGRAPHY OF THE ICHTHYOFAUNA FROM EASTER ISLAND (ISLA DE PASCUA).] *An. Cent. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex.* 2(1):29-52. 1975. In Spanish with English summ. SFA 27(4)
[Cent. Cienc. Mar. Limnol., Univ. Nac. Auton. Mex., Cuidad Univ., Mexico 20, D.F.]

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY

82-002659 Becker, C. D.; D. A. Neitzel and D. H. Fickeisen. EFFECTS OF DEWATERING ON CHINOOK SALMON REDDS: TOLERANCE OF FOUR DEVELOPMENTAL PHASES TO DAILY DEWATERINGS. *Trans. Am. Fish. Soc.* 111(5):624-637. Sept. 1982. SFA 27(4)
[Environ. Sci. Dep., Pac. Northwest Lab., Richland, WA 99352]

82-002660 Gulland, J. A. WHY DO FISH NUMBERS VARY? *J. Theor. Behav.* 97(1):69-75. 7 July 1982. SFA 27(4)
[Dep. Fish., FAO, Rome, Italy]

82-002661 Healey, M. C. TIMING AND RELATIVE INTENSITY OF SIZE-SELECTIVE MORTALITY OF JUVENILE CHUM SALMON (*ONCORHYNCHUS KETA*) DURING EARLY SEA LIFE. *Can. J. Fish. Aquatic Sci.* 39(7):952-957. July 1982. In English with French summ. SFA 27(4)
[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

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82-002662 Heufelder, G. R.; D. J. Jude and F. J. Tesar. EFFECTS OF UPWELLING ON LOCAL ABUNDANCE AND DISTRIBUTION OF LARVAL ALEWIFE (*ALOSA PSEUDOHARENGUS*) IN EASTERN LAKE MICHIGAN. *Can. J. Fish. Aquatic Sci.* 39(11):1531-1537. Nov. 1982. In English with French summ. SFA 27(4)
[Great Lakes Res. Div., Inst. Sci. Technol., Univ. Mich., Ann Arbor 48109]

82-002663 Marí, A. and R. Coyula. ACTUALIZACIÓN DE LA MORTALIDAD NATURAL DE LA MERLUZA PLATEADA EN LA PLATAFORMA DE NUEVA ESCOCIA. [ESTIMATES OF NATURAL MORTALITY OF SILVER HAKE IN NOVA SCOTIAN WATERS.] *Rev. Cubana Invest. Pesq.* 4(3):79-88. 1979. In Spanish with English summ. SFA 27(4)
[Cent. Invest. Pesq., Miramar, Havana, Cuba] Estimates of natural mortality rates for the Silver hake in Nova Scotian waters were made by means of various techniques. These estimates ranged from 0.23 to 0.69 with an average estimate of 0.44. If we disregard the value of 0.69, then the average would be 0.35, that is a very close figure to the value of 0.4 at present used when dealing with this resource.

82-002664 Maximenkov, V. V. [FOOD SUPPLY FOR HERRING LARVAE AND ITS RELATION TO THE NUMBERS OF GENERATIONS.] *Zool. Zh.* 61(8):1180-1187. Aug. 1982. In Russian with English summ. SFA 27(4)
[Kamchatka Div. Pac. Res. Inst. Fish. Oceanogr., Petropavlovsk-Kamchatsky, USSR] There exists an inverse relationship between the mortality of herring fry and the food supply for their larvae, and it can be expressed by an equation $Z=-a(\ln X+b)$, where Z is mortality coefficient for fry, X is food supply during transition to exogenous feeding; a and b are coefficients. Such a relationship was found for *Clupea harengus pallasi*, *Clupeonella delicatula* and *Engraulus encrasicholus*.

82-002665 Miglarese, J. V.; C. W. McMillan and M. H. Shealy, Jr. SEASONAL ABUNDANCE OF ATLANTIC CROAKER (*MICROPOGONIAS UNDULATUS*) IN RELATION TO BOTTOM SALINITY AND TEMPERATURE IN SOUTH CAROLINA ESTUARIES. *Estuaries* 5(3):216-223. Sept. 1982. SFA 27(4)
[Manage. Syst. Lab., VPI&SU, 617 N. Marst St., Blacksburg, VA 24061] During 1973 and 1974 seasonal abundance and mean total length of Atlantic croaker, *Micropogonias undulatus*, were investigated by otter trawl at 33 stations in South Carolina estuaries in relation to bottom salinity and temperature. Relative abundance of Atlantic croaker was measured by catch per unit effort at 3°C temperature intervals and 3 °/oo salinity intervals. Croaker occurred over a bottom temperature range of 9.0-31.4°C while occurring most abundantly in waters above 24.0°C. No significant correlation between size and temperature was found. Croaker were collected in salinities from 0.4 to 34.4 °/oo. High correlations of size and salinity were evident in 1973 during winter (r=0.79), summer (r=0.82), and fall (r=0.94). In 1974, correlations were significant only during fall (r=0.76).

82-002666 Moksness, E. FOOD UPTAKE, GROWTH AND SURVIVAL OF CAPELIN LARVAE (*MALLOTUS VILLOSUS* MÜLLER) IN AN OUTDOOR CONSTRUCTED BASIN. *Fiskeridir. Skr. Ser. Havunders.* 17(7):267-285. 1982. SFA 27(4)
[Stn. Biol. Stasjon Flødevigen 4800 Arendal, Norway]

82-002667 Serns, S. L. RELATION OF TEMPERATURE AND POPULATION DENSITY TO FIRST-YEAR RECRUITMENT AND GROWTH OF SMALLMOUTH BASS IN A WISCONSIN LAKE. *Trans. Am. Fish. Soc.* 111(5):570-574. Sept. 1982. SFA 27(4)
[Wis. Dep. Nat. Resour., Box 440, Woodruff 54568]

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[Biol. Stn., St. Andrews, NB E0G 2X0, Canada] The Westfield River, Nova Scotia, a tributary of the Medway River, was selected as a study area to investigate stream fish production in an acid stream. Flow regimes in three sub-drainage basins of the Westfield were estimated, using hydrologic data from adjacent watersheds as models. Historical and present land usages in the Westfield drainage were also reviewed.

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[Va. Inst. Mar. Sci., Coll. William and Mary, Goucester Point, VA 23062] During 1973 and 1974 seasonal abundance and mean total length of Atlantic croaker, *Micropogonias undulatus*, were investigated by otter trawl at 33 stations in South Carolina estuaries in relation to bottom salinity and temperature. Relative abundance of Atlantic croaker was measured by catch per unit effort at 3°C temperature intervals and 3o/oo salinity intervals. Croaker occurred over a bottom temperature range of 9.0-31.4°C while occurring most abundantly in waters above 24.°C. No significant correlation between size and temperature was found. Croaker were collected in salinities from 0.4 to 34.4o/oo. High correlations of size and salinity were evident in 1973 during winter (r=0.79), summer (r=0.82, and fall (r=0.94). In 1974, correlations were significantly only during fall (r=0.76).

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[Camp Dresser & McKee Inc., Environ. Sci. Div., 11455 West 48th Ave., Wheat Ridge, CO 80033] Acid mine drainage from an abandoned mone has entered Coal Creek, a small stream in western Colorado since about 1945. As a result of water quality degradation, the reach of Coal Creek extending from below the drainage outfall to its confluence with the Slate River (4.0 km distance) has been essentially devoid of aquatic life. Viable brook and brown trout populations exist above and below this section of stream. In 1981, AMAX, Inc., a mining company with interests in developing an area adjacent to Coal Creek, Commenced the operation of a heavy metals treatment plant designed to eradicate the water quality problems of the acid drainage. Within one month following plant operation, aquatic invertebrates were observed in the stream and within 2-3 months fish were recovered throughtou the stream reach. Since a barrier deters downstream fish migration into the reclaimed section of Coal Creek, the majority of fish found throughout the reach probably originated in the Slate River. The reestablishment of fish in Coal Creek has occurred rapidly attesting to the improved water quality and the resiliency and opportunistic nature of aquatic biota.

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[Instant Ocean Hatcheries, Inc., 5616 Old Dade City Rd., Dade City, FL 33525]

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82-002843 Kovacs, T. G. and G. Leduc. ACUTE TOXICITY OF CYANIDE TO RAINBOW TROUT (*SALMO GAIRDNERI*) ACCLIMATED AT DIFFERENT TEMPERATURES. *Can. J. Fish. Aquatic Sci.* 39(10):1426-1429. Oct. 1982. In English with French summ. SFA 27(4)
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[Lab. Limnol., Univ. Wis., Madison 53706]

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82-002848 McWilliams, P. G. A COMPARISON OF PHYSIOLOGICAL CHARACTERISTICS IN NORMAL AND ACID EXPOSED POPULATIONS OF THE BROWN TROUT *SALMO TRUTTA*. *Comp. Biochem. Physiol. A Comp. Physiol.* 72(3):515-522. 1982. SFA 27(4)
[Dep. Biol. Sci., Univ. Lancaster, Bailrigg, Lancaster, LA1 4YQ, Lancashire, England] Ionoregulatory and erythrocytic characteristics are compared in two populations of the brown trout, *Salmo trutta*, one population from a naturally acid, low calcium environment (Galloway, Scotland) and the other from a neutral, high calcium environment (Cumbria, England). Some data from the acid resistant freshwater perch, *Perca fluviatilis*, is included for comparison. Sodium fluxes in the Galloway trout and in the perch are less sensitive to lowered environmental pH. In media containing similar calcium concentrations the Galloway trout exhibit a much reduced gill permeability to H^+ ions and a lower Na^+ permeability than the Cumbrian trout. The perch also shows similar permeability characteristics to the Galloway trout. Erythrocytic characteristics in trout from the naturally acid Galloway region suggest an increased ability to extract and transport oxygen in low pH media.

82-002849 Mensi, P.; A. Arillo; C. Margiocco and G. Schenone. LYSOSOMAL DAMAGE UNDER NITRITE INTOXICATION IN RAINBOW TROUT (*SALMO GAIRDNERI* RICH.). *Comp. Biochem. Physiol. C Comp. Pharmacol.* 73(1):161-165. 1982. SFA 27(4)
[Ist. Zool., Univ. Genova, Italy]

82-002850 Muramato, S. EFFECTS OF COMPLEXANS (DTPA, EDTA) ON THE TOXICITY OF LOW CONCENTRATIONS OF COPPER TO FISH. *J. Environ. Sci. Health A Environ. Sci. Eng. (Marcel Dekker, Inc., N.Y.)* 17(3):313-319. 1982. SFA 27(4)
[Inst. Agric. Biol. Sci., Okayama Univ., Kurashiki 710, Japan]

82-002851 Pohla-Gubo, G. and H. Adam. DER EINFLUß DES ANIONAKTIVEN TENSIDS NA-ALKYL-BENZOLSULFONAT (LAS) AUF DIE KOPF-EPIDERMIS JUVENILER REGENBOGENFORELLEN (*SALMO GAIRDNERI* RICHARDSON). [INFLUENCE OF THE ANIONACTIVE DETERGENT NA-ALKYL-BENZENESULPHONATE (LAS) ON THE HEAD-EPIDERMIS OF JUVENILE RAINBOW TROUT (*SALMO GAIRDNERI* RICHARDSON).] *Zool. Anz.* 209(1-2):97-110. 1982. In German with English summ. SFA 27(4)
[Zool. Inst., Univ. Salzburg, Austria]

TOXICOLOGY; BIOASSAYS (CONTINUED)

82-002852 Roberts, M. H., Jr. and R. E. Bendl. ACUTE TOXICITY OF KEPONE TO SELECTED FRESHWATER FISHES. *Estuaries* 5(3):158-164. Sept. 1982. SFA 27(4)
[Va. Inst. Mar. Sci., Coll. William and Mary, Gloucester Point, VA 23062] The acute toxicity of Kepone in freshwater was determined with three fish species, *Ictalurus punctatus* (channel catfish), *Lepomis macrochirus* (bluegills), and *Anguilla rostrata* (American eel). Elvers of *A. rostrata* were most sensitive with a 96 h lethal concentration for 50% of the animals tested (LC50) of 35μg per l. Bluegills were slightly less sensitive with a 96h LC50 of 50μg per l. Catfish were most tolerant with a 96h LC50 of 514μg per l. Bluegills and catfish exposed to comparable concentrations of Kepone accumulated equivalent amounts in 96h. This observation in conjunction with the markedly different 96h LC50's for these species suggest a difference in the ways these fish cope with Kepone.

82-002853 Rombough, P. J. and E. T. Garside. CADMIUM TOXICITY AND ACCUMULATION IN EGGS AND ALEVINS OF ATLANTIC SALMON *SALMO SALAR*. *Can. J. Zool.* 60(8):2006-2014. Aug. 1982. In English with French summ. SFA 27(4)
[Pac. Biol. Stn., Dep. Fish. Oceans, Nanaimo, BC V9R 5K6, Canada]

82-002854 Sastry, K. V. and S. K. Sharma. ENDRIN INDUCED HEPATIC INJURY IN *CHANNA PUNCTATUS* (HAM.). *Indian J. Fish.* 26(1-2):250-253. 1979. SFA 27(4)
[Dep. Zool., D.A.V. Coll., Muzaffarnagar-251001, India] The effect of a sublethal concentration (0.01 mg/l) of endrin on the histological changes in the liver of a teleost fish, *Channa punctatus* (Ham.) has been studied. The degenerative changes included hypertrophy of hepatic cells and their nuclei, liver cord disarray, vacuolation of cytoplasm and necrosis. In some cells, the cell membrane was ruptured. The centrolobular area was highly necrosed. The liver on the whole showed distorted appearance.

82-002855 Saxena, A. B.; D. Subba Rao and Z. U. Khan. STUDIES ON THE ACUTE TOXICITIES OF COPPER, MERCURY, AND CADMIUM TO *DANIO MALABARICUS* AND *PUNTIUS TICTO*. *J. Environ. Sci. Health A Environ. Sci. Eng. (Marcel Dekker, Inc., N.Y.)* 17(5):657-665. 1982. SFA 27(4)
[Dep. Zool., Madhav Sci. Coll., Vikram Univ., Ujjain (M.P.) 456 010, India]

82-002856 Singh, N. N. and A. K. Srivastava. EFFECT OF FORMOTHION ON CARBOHYDRATE METABOLISM IN INDIAN CATFISH, *HETEROPNEUSTES FOSSILIS*. *Environ. Res.* 28(2):335-339. Aug. 1982. SFA 27(4)
[Dep. Zool., Univ. Gorakhpur 273 001, U.P., India] Exposure of Indian catfish (*Heteropneustes fossilis*) to 10.4 ppm formothion (0, 0-dimethyl-S(*N*-methyl-*N*-formoylcarbamoylmethyl) dithiophosphate) for 3, 6, 12, 48, and 96 hr caused depletion of muscle glycogen at 3, 6, and 48 hr and hepatic glycogenolysis at 6, 12, 48, and 96 hr; hyperglycemia developed at all time intervals. Both blood lactate and pyruvate concentrations registered significant increases between 3 and 96 hr. These results show that evaluation of carbohydrate metabolites may constitute a rapid method for assessment of pesticide toxicity.

82-002857 Stendahl, D. H. and J. B. Sprague. EFFECTS OF WATER HARDNESS AND pH ON VANADIUM LETHALITY TO RAINBOW TROUT. *Water Res.* 16(10):1479-1488. 1982. SFA 27(4)
[Water Resour., DIAND, P.O. Box 1500, Yellowknife, NWT X1A 2R3, Canada] Seven-day LC$_{50}$s of vanadium pentoxide for 2.5-g trout showed only a small range, from 1.9 to 6.0 mg V l^{-1}, in tests at all 12 combinations of 30, 100 and 355 mg l^{-1} total hardness with pH 5.5, 6.6, 7.7 and 8.8. Toxicity decreased from low to high hardness by an average factor of 1.8, probably because of regulated vanadium intake at the gill membranes.

TOXICOLOGY; BIOASSAYS (CONTINUED)

82-002857 CONTINUED Hardness did not exert a major effect, probably because vanadium is present in water as various anions and does not complex with carbonates and bicarbonates as do most metals which behave as cations. Toxicity was greatest at pH 7.7, and the predominating ion $H_2VO_4^-$ was apparently the most toxic one. HVO_4^{2-} which prevailed at high pH, was calculated to be 60% as toxic as $H_2VO_4^-$. Toxicity decreased at pH 6.6 and 5.5, probably because much of the metal was then present as decavanadates, which were found to be half as toxic as $H_2VO_4^-$ on the basis of vanadium content. Small fish were more resistant to vanadium than larger ones, at least up to 12g wet wt. However cumulative mortality continued to increase until 2 weeks of exposure, and incipient lethal levels were probably much the same for fish of different size, at about 60-70% of the 7-d LC_{50}s stated in the paper. The toxicity of vanadium is similar to that of zinc except that it does not show a major change with water hardness.

82-002858 Sylvester, J. R. and L. E. Holland. INFLUENCE OF TEMPERATURE, WATER HARDNESS, AND STOCKING DENSITY ON MS-222 RESPONSE IN THREE SPECIES OF FISH. *Prog. Fish-Cult.* 44(3):138-141. July 1982. SFA 27(4)
[U.S. FWS, Natl. Fish. Res. Lab., P.O. Box 818, LaCrosse, WI 54601]

82-002859 Tandjung, S. D. THE ACUTE TOXICITY AND HISTOPATHOLOGY OF BROOK TROUT (*SALVELINUS FONTINALIS*, MITCHILL) EXPOSED TO ALUMINUM IN ACID WATER. *Ph.D. dissertation, Fordham Univ.* 330p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(3):619. Sept. 1982. SFA 27(4)

82-002860 Thomas, P. C. and T. L. Murthy. CHANGES IN FEW PISCINE ENZYMES DUE TO ENDRIN AND SEVIN TOXICOSIS. *Indian J. Fish.* 25(1-2):1-8. 1978. SFA 27(4)

82-002861 Varanasi, U.; M. Nishimoto; W. L. Reichert and J. E. Stein. METABOLISM AND SUBSEQUENT COVALENT BINDING OF BENZO[a]PYRENE TO MACROMOLECULES IN GONADS AND LIVER OF RIPE ENGLISH SOLE (*PAROPHRYS VETULUS*). *Xenobiotica* 12(7):417-425. July 1982. SFA 27(4)
[NMFS, 2725 Montlake Blvd. East, Seattle, WA 98112]

82-002862 Vuorinen, P. ACUTE TOXICITY OF THE SLIMECIDE FENNOSAN F 50 TO TWO SPECIES OF TROUT AND THE EFFECT OF ACETONE ON THE TOXICITY. *Finn. Fish. Res.* 4:62-68. 1982. SFA 27(4)
[Finn. Game Fish. Res. Inst., Fish. Div., Unioninkatu 45 B 42, SF-00170 Helsinki 17, Finland]

82-002863 Wagner, G. F. and B. A. McKeown. CHANGES IN PLASMA INSULIN AND CARBOHYDRATE METABOLISM OF ZINC-STRESSED RAINBOW TROUT, *SALMO GAIRDNERI*. *Can. J. Zool.* 60(9):2079-2084. Sept. 1982. In English with French summ. SFA 27(4)
[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada]

82-002864 Weis, P. and J. S. Weis. TOXICITY OF METHYLMERCURY, MERCURIC CHLORIDE, AND LEAD IN KILLFISH (*FUNDULUS HETEROCLITUS*) FROM SOUTHAMPTON, NEW YORK. *Environ. Res.* 28(2):364-374. Aug. 1982. SFA 27(4)
[Dep. Anat., Coll. Med. Dent., Newark, NJ 07103]

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82-002865 Woodhead, A. D. and P. C. Bryant. A NOTE ON THE DISTRIBUTION OF ECTOPIC THYROID TISSUE IN FIVE SPECIES OF POECILIID FISHES. *J. Fish Biol.* 21(1):59-62. July 1982. SFA 27(4)

[Biol. Dep., Brookhaven Natl. Lab., Upton, NY 11793] The intraperitoneal injection of polycyclic aromatic hydrocarbons in young Amazon mollies induces proliferation of ectopic thyroid tissue in the spleen. We have surveyed untreated mollies, *Poecilia formosa*, and four closely related poeciliid fishes to see if ectopic thyroid tissue occurs normally in the spleen. If this were the case, it is possible that the tissue may have been stimulated to proliferate by the injected compounds. We found no instances of ectopic thyroid at any site in 50 untreated Amazon mollies examined nor in some 50 spleens dissected from other untreated fish. Splenic thyroid tissue was found in five guppies from 50 surveyed, but did not occur in other species.

82-002866 Woodworth, J. and D. Pascoe.CADMIUM TOXICITY TO RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON: A STUDY OF EGGS AND ALEVINS. *J. Fish Biol.* 21(2):47-57. July 1982. SFA 27(4)

[Dep. Appl. Biol., UWIST, King Edward VII Ave., Cardiff CF1 3NU, Wales]

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82-002867 Burress, R. M. EFFECTS OF SYNERGIZED ROTENONE ON NONTARGET ORGANISMS IN PONDS. *U.S. Fish Wildl. Serv. Invest. Fish Control* 91. 7p. 1982. SFA 27(4)

[U.S. Fish Wildl. Serv., Southeast. Fish Control Lab., P.O. Box 9, Warm Springs, GA 31830]

82-002868 Dawson, V. K.; J. B. Sills and C. W. Luhning. ACCUMULATION AND LOSS OF 2',5-DICHLORO-4'-NITROSALICYLANILIDE (BAYER 73) BY FISH: LABORATORY STUDIES. *U.S. Fish Wildl. Serv. Invest. Fish Control* 90. 5p. 1982. SFA 27(4)

[U.S. Fish Wildl. Serv., Natl. Fish. Res. Lab., P.O. Box 818, La Crosse, WI 54601]

82-002869 Gilderhus, P. A. EFFECTS OF AN AQUATIC PLANT AND SUSPENDED CLAY ON THE ACTIVITY OF FISH TOXICANTS. *N. Am. J. Fish. Manage.* 2(3):301-306. 1982. SFA 27(4)

[U.S. FWS, Natl. Fish. Res. Lab., P.O. Box 818, La Crosse, WI 54601]

82-002870 Serns, S. L. and M. H. Hoff. EFFECTS OF THE COMBINED USE OF TWO FISH TOXICANTS, ANTIMYCIN-A AND ROTENONE, ON THE ZOOPLANKTON OF A NORTHERN WISCONSIN BOG LAKE. *Wis. Dep. Nat. Resour. Res. Rep.* 120. 7p. Sept. 1982. SFA 27(4)

[Wis. Dep. Nat. Resour., Bur. Res., Woodruff] The influence of the combined application of 3.8μg/l a.i. of antimycin-A (Fintrol-5^{R}) on 13 May 1980, and 0.05 mg/l a.i. rotenone (2.0 mg/l Prentox-Synpren-Fish^{R}) on 21 May 1980, on the zooplankton of Spruce Lake, Wisconsin, was investigated. Samples collected before and after toxicant application indicated a drastic decrease in both copepods and cladocerans immediately after the application of antimycin. No copepods or cladocerans were collected until 18 July (none were found on 14 July) approximately 2 months after toxicant application. The major cladoceran species and cyclopoid copepods exhibited midsummer to early fall pulses during 1980. These pulses appeared to be somewhat delayed, however, when compared with pulses the following year (1981). Calanoid copepods did not rebound from the effects of the treatment until summer 1981, over one year after treatment.

RESEARCH AND MANAGEMENT-GENERAL

82-002871 Brauhn, J. L. and H. Kincaid. SURVIVAL, GROWTH, AND CATCHABILITY OF RAINBOW TROUT OF FOUR STRAINS. *N. Am. J. Fish. Manage.* 2(1):1-10. 1982. SFA 27(4)
[Natl. Fish. Res. Dev. Lab., R.D. #4, Box 47A, Wellsboro, PA 16901]

82-002872 Connell, J. J. RECENT TRENDS IN FISH SCIENCE AND TECHNOLOGY. *Bull. Jpn. Soc. Sci. Fish.* 48(8):1029-1040. Aug. 1982. SFA 27(4)
[Torrey Res. Stn., Aberdeen, Scotland]

82-002873 Deriso, R. B. RELATIONSHIP OF FISHING MORTALITY TO NATURAL MORTALITY AND GROWTH AT THE LEVEL OF MAXIMUM SUSTAINABLE YIELD. *Can. J. Fish. Aquatic Sci.* 39(7):1054-1058. July 1982. In English with French summ. SFA 27(4)
[Int. Pac. Halibut Comm., P.O. Box 5009, University Station, Seattle, WA 98105]

82-002874 Dotson, T. MORTALITIES IN TROUT CAUSED BY GEAR TYPE AND ANGLER-INDUCED STRESS. *N. Am. J. Fish. Manage.* 2(1):60-65. 1982. SFA 27(4)
[Mont. Dep. Fish Wildl. Parks, Yellowstone River Trout Hatchery, Big Timber 59011]

82-002875 Eiserman, F. M. PERSPECTIVES ON FISHERY BIOLOGY IN THE PRIVATE SECTOR. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:195-203. 1982. Available @$10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)
[330 S. Center, #202, Casper, WY 82601]

82-002876 Johnson, D. L.; S. V. Emerson and S. W. Schwerzel. USING BIBLIOGRAPHIC INSTRUCTION TO IMPROVE RESEARCH PAPER QUALITY. *Fisheries (Bull. Am. Fish. Soc.)* 7(5):14-17. Sept.-Oct. 1982. SFA 27(4)
[2021 Coffey Rd., Columbus, OH 43210] As a result of poor quality term papers from inadequate bibliographic searches in an introductory fisheries management class we included bibliographic instruction on a experimental basis. Sixteen topics were selected from available library materials and each student chose from these a subject for a ten-page term paper. Librarians provided classroom lectures on the use of libraries and one hour of practical search strategy application. Two homework exercises ensured library familiarization. Students concurrently submitted library logs (diaries) recording search techniques used during the library search and comprehensive bibliographies on their chosen subjects. Four weeks later the term paper was due. This multifaceted approach produced papers dramatically improved over papers from four previous years. Concepts were more thoughtfully conceived and the literature more carefully integrated and evaluated than in years past. Significant increases were observed in number of references cited (1981 $\bar{x}$ = 12.7 vs. 1976-1979 $\bar{x}$ = 8.03), in the diversity of references used (1981 $\bar{x}$ = 3.09 vs 1976-1979 $\bar{x}$ = 2.67), and in the number of integrating statements per paper (1982 $\bar{x}$ = 6.76 vs 1976-1979 $\bar{x}$ = 1.62). Our experience indicates that comprehensive bibliographic training requires close coordination with librarians and some changes in course integrating and perhaps teaching philosophy. Ancillary rewards include more student time spent in libraries, more efficient use of librarian's teaching skills, and better evaluation and justification of increasing library holdings in specific areas.

RESEARCH AND MANAGEMENT-GENERAL (CONTINUED)

82-002877 Johnson, J. E. and J. N. Rinne. THE ENDANGERED SPECIES ACT AND SOUTHWEST FISHES. *Fisheries (Bull. Am. Fish. Soc.)* 7(4):2-8. July-Aug. 1982. SFA 27(4)
[U.S. FWS, Off. Endangered Species, Albuquerque, NM]

82-002878 Kramer, B. M. LEGAL ASPECTS OF USE AND DEVELOPMENT OF WILDLIFE RESOURCES ON PRIVATE LANDS: COLORADO, KANSAS, NEW MEXICO, OKLAHOMA, TEXAS. *Great Plains Agric. Counc. Publ.* No. 103. ii + 70p. 1982. SFA 27(4)
[Tex. Tech. Univ., Sch. Law, Lubbock]

82-002879 Loftus, K. H., (ed.). PROCEEDINGS OF THE 1980 NORTH AMERICAN EEL CONFERENCE. *Ont. Fish. Tech. Rep. Ser.* No. 4. vi + 97p. 1982. SFA 27(4)

82-002880 Lotspeich, F. B. and W. S. Platts. AN INTEGRATED LAND-AQUATIC CLASSIFICATION SYSTEM. *N. Am. J. Fish. Manage.* 2(2):138-149. 1982. SFA 27(4)
[U.S. For. Serv., 319 SW Pine St., Box 3623, Portland, OR 97208]

82-002881 Rigler, F. H. RECOGNITION OF THE POSSIBLE: AN ADVANTAGE OF EMPIRICISM IN ECOLOGY. *Can. J. Fish. Aquatic Sci.* 39(9):1323-1331. Sept. 1982. In English with French summ. SFA 27(4)
[Dep. Biol., McGill Univ., Montreal, PQ H3A 1B1, Canada]

82-002882 Rikhter, V. A. THE DYNAMICS OF OPTIMUM FISHING INTENSITY OF FISH SPECIES WITH STRONG FLUCTUATIONS IN ABUNDANCE. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(4):38-48. 1981. SFA 27(4)
[AtlantNIRO, Kaliningrad, USSR] An attempt is made to clarify the concept of "optimum fishing intensity." The dynamics of the biomass of the commercial stocks of fish and catches with various levels of fishing mortality and recruitment were analyzed. The validity of assumptions regarding the increase in the coefficient of natural mortality with age and the decrease under the influence of fishing was examined. A dependence was discovered between the rate of increase in catches and recruitment. The influence of this dependence on the value of the optimum fishing intensity was investigated in connection with an assessment of the total allowable catch.

82-002883 Stange, D. AN OPEN LETTER TO ANGLERS AND FISHERIES PROFESSIONALS. *N. Am. J. Fish. Manage.* 1(2):193-199. 1981. SFA 27(4)
[In-Fisherman, Brainerd, MN 56401]

82-002884 Stone, M. D. ENVIRONMENTAL PROTECTION: FACT OR FICTION. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:56-60. 1982. Available @$10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)
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82-002885 Brouha, P. THE FOREST PLANNING GAME. *Fisheries (Bull. Am. Fish. Soc.)* 7(5):11-13. Sept.-Oct. 1982. SFA 27(4)
[U.S. For. Serv., Federal Bldg., Missoula, MT 59807]

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82-002886 Great Lakes Fishery Commission. GREAT LAKES FISHERY COMMISSION ANNUAL REPORT FOR THE YEAR 1979. *Great Lakes Fish. Comm. Annu. Rep.* 1979. 146p. 1982. SFA 27(4)
[1451 Green Rd., Ann Arbor, MI]

82-002887 Great Lakes Fishery Commission. GREAT LAKES FISHERY COMMISSION ANNUAL REPORT FOR THE YEAR 1978. *Great Lakes Fish. Comm. Annu. Rep.* 1978. 132p. 1982. SFA 27(4)
[1451 Green Rd., Ann Arbor, MI]

82-002888 International Pacific Halibut Commission. INTERNATIONAL PACIFIC HALIBUT COMMISSION ANNUAL REPORT 1981. *Int. Pac. Halibut Comm. Annu. Rep.* 1981. 48p. 1982. SFA 27(4)
[P.O. Box 5009, University Station, Seattle, WA 98105]

82-002889 International Pacific Salmon Fisheries Commission. REPORT OF THE INTERNATONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1981. *Int. Pac. Salmon Fish. Comm. Annu. Rep.* 1981:1-48. 1982. SFA 27(4)
[New Westminster, BC, Canada]

82-002890 Kainji Lake Research Institute. ANNUAL REPORT 1979-80. *Kainji Lake Res. Inst. Annu. Rep.* v + 73p. 1981. SFA 27(4)
[New Bussa, Nigeria]

82-002891 Kirka, A. A REVIEW OF THE EXISTING RESEARCH ACTIVITY OF THE LABORATORY OF FISHERY RESEARCH AND HYDROBIOLOGY, BRATISLAVA. *Pr. Lab. Ryb. Hydrobiol.* 3:7-18. 1981. SFA 27(4)
[Lab. Fish. Res. Hydrobiol., Drieňová 3, 829 68, Bratislava, Czechoslovakia]

82-002892 Scott, D. P. BIENNIAL REPORT - 1978-80, WESTERN REGION, DEPARTMENT OF FISHERIES AND OCEANS. *Can. Tech. Rep. Fish. Aquatic Sci.* No. 1068. vi + 42p. Aug. 1982. In English and French. SFA 27(4)
[Dep. Fish. Oceans, Winnipeg, MB R3T 2N6, Canada]

HABITAT ALTERATIONS

82-002893 Binns, N. A. STREAM IMPROVEMENT IN WYOMING. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:42-47. 1982. Available @ $10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)
[Wyo. Game Fish Dep., P.O. Box 342, Lander 82520]

82-002894 Buckley, R. M. MARINE HABITAT ENHANCEMENT AND URBAN RECREATIONAL FISHING IN WASHINGTON. *Mar. Fish. Rev.* 44(6-7):28-37. June-July 1982. SFA 27(4)
[Wash. Dep. Fish., 115 Gen. Admin. Bldg., Olympia 98504] A marine fish enhancement program started in 1974 has emphasized the use of habitat enhancement structures (artificial reefs), both in conjunction with public fishing piers and to create "fishing reefs" for boat anglers, to improve urban recreational fishing in Puget Sound. The enhanced areas were desinged and sited to develop biologically into replicates of natural rocky reef

HABITAT ALTERATIONS (CONTINUED)

82-002894 CONTINUED communities in order to promote productive fisheries. The site selection process was based on indexes of the macrobiota assemblages on rocky reef control areas in the same region and on consideration of potential impacts on fisheries and commerce. Experimental design strategies for both the entire habitat enhancement area and the individual enhancement structures were used to determine the optimum balance between aggregation and production of target species and management for sustained, quality fisheries. Major structural design elements were found to be horizontal and vertical relief and numbers and sizes of interstitial spaces. Abundant and diverse algal growth on the enhancement structures increases habitat complexity and heterogeneity, and may well be the most important element in the transition from introduced materials to replicates of productive natural reefs. Successional development of fish communities appears to proceed from a primcipally aggregated species base during initial colonization to a "forager-aggregater" community structure as food items develop on the enhancement structures.

82-002895 Conder, A. L. APPLICATION OF U.S. FISH AND WILDLIFE SERVICE INCREMENTAL METHODOLOGY ON SELECTED STREAMS: WYOMING. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:48-55. 1982. Available @ $10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)
[Wyo. Game Fish Dep., Cheyenne 82002]

82-002896 Dugas, R.; V. Guillory and M. Fischer. OIL RIGS AND OFFSHORE SPORT FISHING IN LOUISIANA. *La. Dep. Wildl. Fish. Tech. Bull.* No. 35. p. 85. Sept. 1982. Abstract only. SFA 27(4)

82-002897 Grant, J. J.; K. C. Wilson; A. Grover and H. A. Togstad. EARLY DEVELOPMENT OF PENDLETON ARTIFICIAL REEF. *Mar. Fish. Rev.* 44(6-7):53-60. June-July 1982. SFA 27(4)
[Calif. Dep. Fish Game, 350 Golden Shore, Long Beach, CA 90802] An artificial reef was constructed of 9,100 t(10,000 tons) of quarry rock, in southern California, 1.6 km (1 mile) off shore of Camp Pendleton. The reef was arranged in eight high-relief modules covering 2.8 hectares (7 acres) of sand substrate in 13.1 m (43 feet) of water. Management techniques are being utilizated in an effort to accelerate and direct successional changes on the reef. These have included transplanting giant kelp, *Macrocystis* spp., and red abalone, *Haliotis rufescens*. Successional changes and the impact of management operations on the reef were monitored. After 1 year 19 species of fishes and 26 species of invertebrates were observed.

82-002898 Grove, R. S. ARTIFICIAL REEFS AS A RESOURCE MANAGEMENT OPTION FOR SITING COASTAL POWER STATIONS IN SOUTHERN CALIFORNIA. *Mar. Fish. Rev.* 44(6-7):24-27. June-July 1982. SFA 27(4)
[Res. Dev. Div., South. Calif. Edison Co., Rosemead, CA 91770]

82-002899 Guillory, V. A COMPARISON OF FISH POPULATIONS IN BASELINE AND DREDGED AREAS IN LAKE PONTCHARTRAIN. *La. Dep. Wildl. Fish. Tech. Bull.* No. 35. p. 63-67. Sept. 1982. SFA 27(4)

82-002900 Guillory, V. ENVIRONMENTAL EFFECTS OF ESTUARINE DREDGING AND SPOIL DISPOSAL, A LITERATURE REVIEW. *La. Dep. Wildl. Fish. Tech. Bull.* No. 35. p. 37-61. Sept. 1982. SFA 27(4)
The environmental effects of channel dredging in estuaries are reviewed in this report. Major changes occurring in conjunction with channelization include: (1) water quality degradation, including increases in total

HABITAT ALTERATIONS (CONTINUED)

82-002900 CONTINUED suspended solids and oxygen demand and possible release of toxicants bound to the sediments; (2) increased turbidity and sedimentation because of suspension of sediments and formation of mud flows; (3) physical removal of organisms; (4) physical changes in habitat such as creation of deep channels in shallow littoral zones, changes in sediment composition, loss of aquatic vegetation, and formation of spoil islands; (5) increased salinity intrusion associated with movement of high saline water into and through channels; (6) hydrological regime alteration brought about by the placement of spoil islands and channels; (7) increased erosion; and (8) secondary effects caused by increased residential and industrial growth. Most dredge channels also require periodic maintenance dredging, thereby resulting in further environmental changes. Effects of these physico-chemical modifications on the estuarine biota are discussed. General guidelines and criteria to minimize ecological damage from dredge projects are listed. A supplemental bibliography of papers not cited in the present article is also included.

82-002901 Hassemer, P. F. and B. E. Rieman. OBSERVATIONS OF DEEP-SPAWNING KOKANEE ON ARTIFICIALLY CREATED SPAWNING HABITAT. *N. Am. J. Fish. Manage.* 1(2):173-176. 1981. SFA 27(4)
[Dep. Fish. Resour., Coll. For. Wildl. Range Sci., Univ. Idaho, Moscow 83843]

82-002902 Hilgert, P. EVALUATION OF INSTREAM FLOW METHODOLOGIES FOR FISHERIES IN NEBRASKA. *Nebr. Game Parks Comm. Tech. Ser.* No. 10. 50p. 1982. SFA 27(4)
[Nebr. Game Parks Comm., Lincoln] Five instream flow methods were applied to a variety of streams within the state of Nebraska. These were 1) the Tennant method, 2) a modification of the Tennant method, 3) IFG1A, a single cross-section average-parameter method, 4) the Incremental method, using the WSP hydraulic simulation program and 5) the Incremental method, using the IFG4 hydraulic simulation program. Each method was applied following standard published procedures, and instream flow recommendations were developed for the streams addressed using each method separately. Evaluation of the methods showed that the modification of the Tennant method overcame some of the deficiencies of the Tennant method and appears to be most useful for Nebraskan reconnaissance-grade studies. Where insteam flow issues might be resolved through negotiation, or where they involve valuable fishery resources, the Incremental method might be justified. An investigator, using WSP program for unstable bed streams and the IFG4 program for stable bed streams, can assess the effects of altered flow regimes on stream fisheries. Although requiring a greater time and financial commitment, the Incremental method can be used to provide the information needed for responsibly resolving conflicts.

82-002903 Honda, K.; H. Myose and T. Sawada. [COMPARISON EXPERIMENT BETWEEN A MODEL AND A FULL SCALE ARTIFICIAL FLOATING FISH REEF.] *Bull. Jpn. Soc. Sci. Fish.* 48(7):927-931. July 1982. In Japanese with English summ. SFA 27(4)
[4-10, Nishigomon 2, Kamakura, Kanagawa 248, Japan]

82-002904 Hueckel, G. J. and R. L. Stayton. FISH FORAGING ON AN ARTIFICIAL REEF IN PUGET SOUND, WASHINGTON. *Mar. Fish. Rev.* 44(6-7):38-44. June-July 1982. SFA 27(4)
[Wash. Dep. Fish., 115 Gen. Admin. Bldg., Olympia 98504] This study was designed to determine the degree of foraging by striped seaperch, *Embiotoca lateralis*; pile perch *Rhacochilus vacca*; and quillback rockfish,

HABITAT ALTERATIONS (CONTINUED)

82-002904 CONTINUED *Sebastes maliger*, on organisms associated with an artificial reef in Puget Sound, Wash. Stomachs of these fish species, dissected from 609 fish speared on, around, and near the artificial reef between August 1977 and December 1978, were examined and the contents were compared with organisms present in the immediate area. Medium and large fish (over 121 mm for all three species) foraged more on organisms associated with the artificial reef than did small fish of the same species. Abundance of preferred food items of medium and large striped seaperch and quillback rockfish associated with the artificial reef was an important factor in attracting large numbers of these species. Conversely, medium and large pile perch were largely absent from the artificial reef due to a lack of preferred food items.

82-002905 Platts, W. S. LIVESTOCK AND RIPARIAN-FISHERY INTERACTIONS: WHAT ARE THE FACTS? *Trans. N. Am. Wildl. Nat. Resour. Conf.* 47:507-515. 1982. SFA 27(4)
[U.S. For. Serv., Intermountain For. Range Exp. Stn., Boise, ID]

82-002906 Rinne, J. N. MOVEMENT, HOME RANGE, AND GROWTH OF A RARE SOUTHWESTERN TROUT IN IMPROVED AND UNIMPROVED HABITATS. *N. Am. J. Fish. Manage.* 2(2):150-157. 1982. SFA 27(4)
[Rocky Mtn. For. Range Exp. Stn., For. Sci. Lab., ASU Campus, Tempe, AZ 85287]

82-002907 Schlosser, I. J. TROPHIC STRUCTURE, REPRODUCTIVE SUCCESS, AND GROWTH RATE OF FISHES IN A NATURAL AND MODIFIED HEADWATER STREAM. *Can. J. Fish. Aquatic Sci.* 39(7):968-978. July 1982. In English with French summ. SFA 27(4)
[Dep. Biol., Box 8238, University Station, Grand Forks, ND 58202]

82-002908 Sheehy, D. J. THE USE OF DESIGNED AND PREFABRICATED ARTIFICIAL REEFS IN THE UNITED STATES. *Mar. Fish. Rev.* 44(6-7):4-15. June-July 1982. SFA 27(4)
[Aquabio, Inc., 2957 Sunset Blvd., Belleair Bluffs, FL 33540] Designed and prefabricated artificial reefs have been used with great success to promote fisheries development in Japan and Taiwan, and have been tested on several occasions in the United States. Although efforts in the early 1960's to test Japanese-style reefs in California, New York, and Florida met with problems due to lack of experiecence with that type of reef, those units which were properly placed proved effective in attracting fish. Pumice concrete shelters designed for lobsters were tested in Rhode Island in the 1970's and were shown to increase significantly the abundance of resident lobsters in areas previously devoid of shelter. The Japanese have recently developed a new generation of large-scale, advanced-technology artificial reefs. To introduce this technology in the United States, Japanese FRP (fiberglass reinforced plastic) reefs have been installed off Florida as part of a demonstration/research project funded by the National Marine Fisheries Service. Their cost-effectiveness will be evaluated by comparing them with concrete culvert reefs.

82-002909 Stone, R. B. ARTIFICIAL REEFS: TOWARD A NEW ERA IN FISHERIES ENHANCEMENT? *Mar. Fish. Rev.* 44(6-7):2-3. June-July 1982. SFA 27(4)
[NMFS, Washington, DC 20235]

HABITAT ALTERATIONS (CONTINUED)

82-002910 Terashima, A. and T. Ueda. [EFFECTS OF BOTTOM DREDGING ON SOME ENVIRONMENTAL FACTORS AND BENTHIC ANIMALS IN THE SOUTH BASIN OF LAKE BIWA.] *Jpn. J. Limnol.* 43(2):81-87. Apr. 1982. In Japanese with English summ. SFA 27(4)
[Otsu Hydrobiol. Stn., Kyoto Univ., Shimosakamoto, Otsu, Shiga-ken, 520-01, Japan]

82-002911 Timmons, T. J. and W. L. Shelton. MARKING FISH ATTRACTORS IN LAKES WITH FLUCTUATING WATER LEVELS. *N. Am. J. Fish. Manage.* 2(1):97. 1982. SFA 27(4)
[Auburn Agric. Exp. Stn., Dep. Fish. Allied Aquacult., Auburn Univ., AL 36849]

82-002912 Walton, J. M. THE EFFECTS OF AN ARTIFICIAL REEF ON RESIDENT FLATFISH POPULATIONS. *Mar. Fish. Rev.* 44(6-7):45-48. June-July 1982. SFA 27(4)
[Peninsula Coll., Port Angeles, WA 98362]

82-002913 Woodhead, P. M. J.; J. H. Parker and I. W. Duedall. THE COAL-WASTE ARTIFICIAL REEF PROGRAM (C-WARP): A NEW RESOURCE POTENTIAL FOR FISHING REEF CONSTRUCTION. *Mar. Fish. Rev.* 44(6-7):16-23. June-July 1982. SFA 27(4)
[Mar. Sci. Res. Cent., State Univ. N.Y., Stony Brook 11794] The feasibility of using solid blocks of waste material from coal_fired power plants for underwater construction, including building artificial fishing reefs, is being tested. On 12 September 1980, a 500-ton demonstration reef, consisting of 15,000 solid blocks of satabilized fly ash and flue-gas desulfurization (scrubber) sludge from coal-burning power stations, was constructed in the Atlantic Ocean off Long Island, N.Y. Biological settlement and epifaunal colonization are already well established. Fishes inhabit the reef at high population densities, and crabs and lobsters have begun to immigrate. Laboratory and sea experiments over the past 5 years suggest that stabilized coal waste blocks may be environmentally acceptable in the ocean.

HARVEST, CREEL CENSUS, ETC.

82-002914 Bimber, D. L. and A. A. Nigro. THE SPRING SALMONID FISHERY NEAR A THERMAL DISCHARGE IN LAKE ERIE AT DUNKIRK HARBOR. *Ohio J. Sci.* 82(4):193-195. Sept. 1982. SFA 27(4)
[Great Lakes Res. Div., Inst. Sci. Technol. Bldg., Univ. Mich., Ann Arbor 48109] A creel survey was conducted from 10 March to 30 April 1977 in Dunkirk harbor located on the eastern shore of Lake Erie. Coho salmon (*Oncorhynchus kisutch*), rainbow trout (*Salmo gairdneri*), and brown trout (*Salmo trutta*) comprised 55% of angler harvest. Finclips indicated that 13.5% of coho salmon caught in the harbor had been stocked in Ohio tributaries of the lake. Average catch per unit effort estimates for the salmonid part of the catch were 0.298 fish per hour (pier) and 0.322 fish per hour (boat) for successful salmonid anglers. The estimated total weight of the salmonid catch taken during the study was 610 kg.

82-002915 Bjerknes, V. and A. Vaag. MIGRATIONS AND CATCH STATISTICS OF THE PINK SALMON, *ONCORHYNCHUS GORBUSCHA*, IN THE FINNMARK AREA, NORTHERN NORWAY. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 21(1):48-53. 1981. SFA 27(4)
[Dir. Fish. Freshwater Fishes, Arendal, Norway]

HARVEST, CREEL CENSUS, ETC. (CONTINUED)

82-002916 Devadoss, P. A PRELIMINARY STUDY ON THE BATOID FISHERY OF CUDDALORE WITH A NOTE ON THE BIOLOGY. *Indian J. Fish.* 25(1-2):180-187. 1978. SFA 27(4)

82-002917 Krishnamoorthi, B. A NOTE ON THE CATCH TRENDS OF CATFISHES *TACHYSURUS THALASSINUS* AND *T. TENUISPINIS* BASED ON EXPLORATORY DATA FOR THE PERIOD FROM 1966 TO 1976. *Indian J. Fish.* 25(1-2):268-270. 1978. SFA 27(4)

82-002918 Kunjipalu, K. K. and A. C. Kuttappan. NOTE ON AN ABNORMAL CATCH OF DEVIL RAYS *DICEROBATIS EREGOODOO* DAY IN GILL NETS OFF VERAVAL. *Indian J. Fish.* 25(1-2):254-256. 1978. SFA 27(4)

82-002919 Kuthalingam, M. D. K.; P. Livingston and P. S. S. Sarma. OBSERVATIONS ON THE CATCHES OF THE MECHANISED BOATS AT NEENAKARA. *Indian J. Fish.* 25(1-2):98-108. 1978. SFA 27(4)

82-002920 Mahadevan Pillai, P. K. A PRELIMINARY STUDY ON THE CATFISH FISHERY OFF BLANGAD ON THE SOUTHWEST COAST OF INDIA. *Indian J. Fish.* 25(1-2):240-242. 1978. SFA 27(4)

82-002921 Prasannakumari, B. and S. K. Dharmaraja. ON THE POMFRET FISHERY OF INDIA WITH SPECIAL REFERENCE TO THE CATCH STATISTICS OF MAHARASHTRA AND GUJARAT COASTS. *Indian J. Fish.* 25(1-2):214-221. 1978. SFA 27(4)

82-002922 Rach, J. J. and F. P. Meyer. WINTER HARVEST OF BLUEGILLS IN 1976-1977 FROM LAKE ONALASKA, WISCONSIN. *N. Am. J. Fish. Manage.* 2(1):28-32. 1982. SFA 27(4)
[U.S. FWS, Natl. Fish. Res. Lab., P.O. Box 818, La Crosse, WI 54601]

82-002923 Thomas, P. A. and M. M. Kunju. ON AN UNUSUAL CATCH OF GHOL *PSEUDOSCIAENA DIACANTHUS* OFF GOA. *Indian J. Fish.* 25(1-2):266-268. 1978. SFA 27(4)

82-002924 Walker, M. H. THE PRESENT STATE OF THE WESTERN AUSTRALIAN FISHERY FOR AUSTRALIAN SALMON. *West. Aust. Dep. Fish. Wildl. Rep.* No. 52. 32p. 1982. SFA 27(4)
[West. Aust. Mar. Res. Lab., P.O. Box 20, North Beach, Western Australia 6020, Australia]

REGULATIONS

82-002925 Anderson, R. M. and R. B. Nehring. THE CATCH AND RELEASE EXPERIENCE ON THE FRYINGPAN AND SOUTH PLATTE RIVERS. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:16-32. 1982. Available @ $10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)
[2126 N. Weber, Colorado Springs, CO 80907] Three years of population data from the South Platte found the catch and release section averaged 3.4 times more biomass and 1.6 times more trout per unit area than the standard regulation area. Fifty-nine percent of the trout population under catch and

REGULATIONS (CONTINUED)

82-002925 CONTINUED release fishing were >30 cm (age 3 or older), compared to only 9 percent in the harvest section. This equates to density estimates of 1,097 and 106 trout >30 cm/ha in the catch and release and standard areas, respectively. A very high catch rate of 1.14 trout per hour was maintained with catch and release compared to 0.65 in the harvest area that had the benefit of catchable stocking. Twenty-five times more trophy size trout (> 38 cm) were caught in the C & R area than in the 8 trout/day section. Standing crop in the standard regulation area of the Fryingpan River dropped dramatically from 136 kg/ha to 84.4 kg/ha just 2 years after stocking was eliminated. In the same time period, biomass increased in the catch and release section from 251-333 kg/ha. Catch statistics for the Fryingpan in the absence of angler mortality showed the mean size of trout was greater and overall catch per man hour (CPMH) was 3 times higher than under standard statewide regulations.

82-002926 Dawson, C. P. and B. T. Wilkins. MOTIVATIONS OF NEW YORK AND VIRGINIA MARINE BOAT ANGLERS AND THEIR PREFERENCES FOR POTENTIAL FISHING CONSTRAINTS. *N. Am. J. Fish. Manage.* 1(2):151-158. 1981. SFA 27(4)
[Dep. Nat. Resour., Cornell Univ., Ithaca, NY 14853]

82-002927 Dunning, D. J.; Q. Ross and J. Gladden. EVALUATION OF MINIMUM SIZE LIMITS FOR ST. LAWRENCE RIVER NORTHERN PIKE. *N. Am. J. Fish. Manage.* 2(2):171-175. 1982. SFA 27(4)
[Power Auth. State N.Y., 10 Columbus Cir., New York 10019]

82-002928 Paragamian, V. L. CATCH RATES AND HARVEST RESULTS UNDER A 14.0-INCH MINIMUM LENGTH LIMIT FOR LARGEMOUTH BASS IN A NEW IOWA IMPOUNDMENT. *N. Am. J. Fish. Manage.* 2(3):224-231. 1982. SFA 27(4)
[Iowa Conserv. Comm., R.R. 2, Box 269, Manchester 52057]

82-002929 Snow, H. E. HYPOTHETICAL EFFECTS OF FISHING REGULATIONS I MURPHY FLOWAGE, WISCONSIN. *Wis. Dep. Nat. Resour. Tech. Rep.* NO. 131. 15p 1982. SFA 27(4)
[Wis. Dep. Nat. Resour., Box 309, Spooner 54801] This paper summarizes the hypothetical effects of bag, season, and size limits on the harvest of panfish, northern pike, and largemouth bass in Murphy Flowage, Wisconsin. Complete angler records were obtained through a compulsory registration-type creel census for 15 years. There were no bag, season, or size limits in effect at any time during the study. The hypothetical reduction in harvest with various regulations was calculated from detailed harvest records. The present bag limits in effect in most of Wisconsin would have had little effect on the observed harvest in Murphy Flowage. A 50-fish daily bag limit on panfish in aggregate would have reduced the observed harvest 2.9% in summer and 13.8% in winter. A 5-fish daily bag on gamefish would have reduced the northern pike harvest 0.5% in summer and 1.5% in winter, while the harvest of largemouth bass would have been reduced 2.5% in summer, with no effect in winter. A year-round open season would have had very little effect on the harvest. A maximum of 7% of the northern pike and 4% of the largemouth bass were taken during the normal closed season, 1 March to the 1st Saturday of May. A later opening date could have a marked effect on the harvest, especially on largemouth bass since 50% of the annual harvest was taken by the end of June. Size limits alone or in combination with later opening dates had the most potential for reducing the observed harvest. A 18-inch limit on northern pike would have reduced the harvest 22% and a 10-inch limit on largemouth bass would have reduced bass harvest 27%. A slot length limit of 18-22 inches on northern pike would have reduced the harvest 40% while a 12- to 15-inch limit on largemouth bass would have reduced bass harvest 30%.

REGULATIONS (CONTINUED)

82-002929 CONTINUED Some important considerations in the use of length limits are: (1) the possibility of losses of the protected sizes due to hooking mortality, (2) possible alteration of the sex ratio of northern pike populations, (3) lack of control of forage species by bass if their preferred diet of crayfish is abundant, and (4) the possibility of reduced growth rates. Other in-depth exploitation and mortality studies in Murphy Flowage have shown that the difference in total mortality with fishing and without fishing is relatively small. Therefore, it was concluded that liberalized regulations within the range of fishing pressure and exploitation experienced in Murphy Flowage were not a detriment to the fish populations, and that the hypothetical results of various regulations closely approximated those that would have been obtained with normal regulations.

FISH CONTROL AND REMOVAL

82-002930 Hazzard, L. K. AIDES TO LAKE REHABILITATION: AERIAL RETENONE APPLICATION AND A SIMPLIFIED DETOXIFICATION PROCEDURE. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:1-7. 1982. Available @ $10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)

[2300 S. Townsend, Montrose, CO 81401] A successful attempt was made to eliminate rough fish from part of a Colorado drainage that contained seven lakes, numerous bogs and fifteen miles of tributaries. The use of a modified fish tank in a Cessna 185 reduced the work effort on the ground and contributed to the success of the project. In addition, the use of a 500-gallon fish tank with a simplified constant flow mechanism prevented fish loss below the desired natural barrier using $KMnO_4$ to detoxify the rotenone. Both the aerial rotenone application and the detoxification process were of great benefit in helping achieve a management target that can benefit the manager and the user of the resource.

MARKING AND TAGGING

82-002931 Boxrucker, J. C. MASS MARKING OF FINGERLING LARGEMOUTH BASS BY FIN-CLIPPING FOLLOWED BY FREEZE-CAUTERIZATION OF THE WOUND. *N. Am. J. Fish. Manage.* 2(1):94-96. 1982. SFA 27(4)

[Okla. Fish. Res. Lab., 1416 Planck St., Norman 73069]

82-002932 Ebener, M. P. and F. A. Copes. LOSS OF FLOY ANCHOR TAGS FROM LAKE WHITEFISH. *N. Am. J. Fish. Manage.* 2(1):90-93. 1982. SFA 27(4)

[Wis. Coop. Fish. Res. Unit, Univ. Wis., Stevens Point 54481]

82-002933 McAfee, M. E. FLUORESCENT PIGMENT SPRAY-MARKING: DO WE KNOW WHERE WE STAND? *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:79-85. 1982. Available @ $10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)

[Colo. Div. Wildl., 711 Independent, Grand Junction 81501]

82-002934 Medved, R. J. AQUARIUM AIRLINE TUBING MARKER FOR OBSERVING FISH MOVEMENTS. *Prog. Fish-Cult.* 44(3):160-161. July 1982. SFA 27(4)

[Grad. Sch. Oceanogr., Univ. R.I., Narragansett 02882]

MARKING AND TAGGING (CONTINUED)

82-002935 Ostergaard, D. E. RETENTION OF CODED WIRE TAGS IN LAKE TROUT. *Prog. Fish-Cult.* 44(3):162. July 1982. SFA 27(4)
[U.S. FWS, Allegheny Natl. Fish Hatchery, Warren, PA 16365]

82-002936 Tranquilli, J. A. and W. F. Childers. GROWTH AND SURVIVAL OF LARGEMOUTH BASS TAGGED WITH FLOY ANCHOR TAGS. *N. Am. J. Fish. Manage.* 2(2):184-187. 1982. SFA 27(4)
[Ill. Dep. Conserv., 600 N. Grand Ave., Springfield 62706]

STOCKING AND INTRODUCTIONS

82-002937 Dickson, T. A. and H. R. MacCrimmon. INFLUENCE OF HATCHERY EXPERIENCE ON GROWTH AND BEHAVIOR OF JUVENILE ATLANTIC SALMON (*SALMO SALAR*) WITHIN ALLOPATRIC AND SYMPATRIC STREAM POPULATIONS. *Can. J. Fish. Aquatic Sci.* 39(11):1453-1458. Nov. 1982. In English with French summ. SFA 27(4)
[Environmental Management Assoc., 1510 Tenth Ave. S.W., Calgary, AB T3C 0J5, Canada]

82-002938 Ellison, J. P. LAKE HENNESSEY CATCHABLE TROUT TAGGING PROGRAM, 1980-81. *Calif. Dep. Fish Game Inland Fish. Admin. Rep.* No. 82-6. 11p. Aug. 1982. SFA 27(4)

Angler harvest of catchable-sized trout at Lake Hennessey and the Hennessey impoundment, Napa County, was assessed using $5.00 reward tags in the fall, winter, and spring of 1980-81. Fish planted in the lake returned at a low rate (11.4%). The return rate of fish planted in the impoundment was better (34.9%) but still below Fish and Game Commission policy standards. Possible reasons for low angler harvest are discussed and management recommendations are made.

82-002939 Harshbarger, T. J. and P. E. Porter. EMBRYO SURVIVAL AND FRY EMERGENCE FROM TWO METHODS OF PLANTING BROWN TROUT EGGS. *N. Am. J. Fish. Manage.* 2(1):84-89. 1982. SFA 27(4)
[Southeast. For. Exp. Stn., USDA, For. Serv., Asheville, NC 28804]

82-002940 Hein, S. and J. Shepard. REARING STRIPED BASS FOR RELEASE INTO THE BARATARIA BAY ESTUARY, SOUTHEAST LOUISIANA. *La. Dep. Wildl. Fish. Tech. Bull.* No. 35. p. 15-35. Sept. 1982. SFA 27(4)

Striped bass, *Morone saxatilis*, were reared and stocked into Barataria Bay, an estuarine system located along the southeast coast of Louisiana. Over a five-year period, 1975-1979, 160,000 fingerling bass were introduced into the system. Commercial fishermen reported capturing stripers, but only one was verified by biologists. It is uncertain whether the fish captured came from this stocking attempt. Various rearing techniques were evaluated. In all cases, minimal handling proved beneficial. Salinity of 10-25 ppt was used to conduct tolerance tests on sacfry bass. No significant loss of fish was encountered at the $\alpha = 0.05$ level.

82-002941 International Council for the Exploraton of the Sea. STATUS (1980) OF INTRODUCTIONS OF NON-INDIGENOUS MARINE SPECIES TO NORTH ATLANTIC WATERS. *Int. Counc. Explor. Sea. Coop. Res. Rep.* No. 116. ii + 87p. May 1982. SFA 27(4)
[Palaegade 204, 1261 Copenhagen, Denmark]

STOCKING AND INTRODUCTIONS (CONTINUED)

82-002942 Laarman, P. W. VITAL STATISTICS OF A MICHIGAN FISH POPULATION, WITH SPECIAL EMPHASIS ON THE EFFECTIVENESS OF STOCKING 15-CM WALLEYE FINGERLINGS. *N. Am. J. Fish. Manage.* 1(2):177-185. 1981. SFA 27(4)
[Inst. Fish. Res., Mich. Dep. Nat. Resour., Ann Arbor 48109]

82-002943 Moring, J. R. AN EFFICIENT HATCHERY STRAIN OF RAINBOW TROUT FOR STOCKING IN OREGON STREAMS. *N. Am. J. Fish. Manage.* 2(3):209-215. 1982. SFA 27(4)
[Me. Coop. Fish. Res. Unit, Dep. Zool., Univ. Me., Orono 04469]

82-002944 Roys, R. S. INTERSTATE AND INTERNATIONAL MANAGEMENT IMPLICATIONS OF SALMON HATCHERY PRODUCTION. *Trans. N. Am. Wildl. Nat. Resour. Conf.* 47:641-647. 1982. SFA 27(4)
[Alaska Dep. Fish Game, Juneau]

82-002945 Skinner, J. M. STOCKING OF A NEW IMPOUNDMENT BY INDIGENOUS STREAM SPECIES: EVALUATION OF A FISHERIES MANAGEMENT TOOL. *Ph.D. dissertation, Ohio State Univ.* 134p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(1):65. July 1982. SFA 27(4)

A non-stocking management strategy was evaluated at Paint Creek Lake, Ohio, from 1974-1978. Objectives included: (1) documentation of ichthyofaunal successional changes in a new reservoir, (2) determination of the length of time needed for ecosystem stability, (3) determination of whether a successful sport fishery can develop in the absence of stocking, and (4) development of specific recommendations for the management of this lake. Succession proceeded as expected with the loss of more riverine species and addition of others that were not common in the free-flowing stream. Total catch at electrofishing index stations peaked in the third and fourth years and declined the the fifth, mainly due to winterkill mortality of the dominant forage fish, gizzard shad (*Dorosoma cepedianum*). Growth was exceptional for most game species in the first three years, but had slowed in the fourth and fifth years. Sport fishing catch rate stayed constant as fishing pressure peaked in the third year and declined thereafter. Sport catch rate was comparable to other stocked Ohio lakes. Species primarily sought and caught were black basses (*Micropterus* sp.), crappies (*Pomoxis* sp.) and bluegill (*Lepomis macrochirus*). Gizzard shad quickly outgrew the predatory ability of the game fish. Additional predatory pressure is recommended to utilize the shad biomass early in its development.

FISHING GEAR AND TECHNIQUES

82-002946 Adkins, G. and M. J. Bourgeois. AN EVALUATION OF GILL NETS OF VARIOUS MESH SIZES. *La. Dep. Wildl. Fish. Tech. Bull.* No. 36. 59p. Sept. 1982. SFA 27(4)

82-002947 Campana, S. E. TECHNIQUE FOR CONVERTING A BEACH SEINE FOR OPERATION BY ONE PERSON. *Prog. Fish-Cult.* 44(3):152-153. July 1982. SFA 27(4)
[Inst. Anim. Resour. Ecol., Univ. British Columbia, Vancouver, BC V6T 1W5, Canada]

82-002948 Jacobs, K. E. and W. D. Swink. ESTIMATIONS OF FISH POPULATION SIZE AND SAMPLING EFFICIENCY OF ELECTROFISHING AND ROTENONE IN TWO KENTUCKY TAILWATERS. *N. Am. J. Fish. Manage.* 2(3):239-248. 1982. SFA 27(4)
[U.S. FWS, East Central Reservoir Invest., Bowling Green, KY 42101]

FISHING GEAR AND TECHNIQUES (CONTINUED)

82-002949 Laarman, P. W. and J. R. Ryckman. RELATIVE SIZE SELECTIVITY OF TRAP NETS FOR EIGHT SPECIES OF FISH. *N. Am. J. Fish. Manage.* 2(1):33-37. 1982. SFA 27(4)
[Mich. Dep. Nat. Resour., Inst. Fish. Res., Ann Arbor 48109]

82-002950 Lilygreen, V. and B. Meade. FISH STOCKS UNDER PRESSURE FROM NYLON MONOFILAMENT GILL-NETS. *Mar. Pollut. Bull.* 13(8):263-266. Aug. 1982. SFA 27(4)

82-002951 MacKenzie, C. L., Jr. COMPATIBILITY OF INVERTEBRATE POPULATIONS AND COMMERCIAL FISHING FOR OCEAN QUAHOGS. *N. Am. J. Fish. Manage.* 2(3):270-275. 1982. SFA 27(4)
[NMFS, Sandy Hook Lab., Highlands, NJ 07732]

82-002952 Main, J. and G. I. Sangster. A STUDY OF SEPARATING FISH FROM *NEPHROPS NORVEGICUS* L. IN A BOTTOM TRAWL. *Scott. Fish. Res. Rep.* No. 24. 8p. 1982. SFA 27(4)
[Mar. Lab., Aberdeen, Scotland]

82-002953 Nishiyama, S.; T. Miura; H. Nakamura and S. Shimizu. [DYNAMIC CHARACTERISTIC OF MID WATER TRAWL NETS.] *Bull. Jpn. Soc. Sci. Fish.* 48(8):1101-1105. Aug. 1982. In Japanese with English summ. SFA 27(4)
[Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

82-002954 Nishiyama, S.; T. Miura; H. Nakamura and S. Shimizu. [STATIC CHARACTERISTIC OF MID WATER TRAWL NETS.] *Bull. Jpn. Soc. Sci. Fish.* 48(8):1095-1100. Aug. 1982. In Japanese with English summ. SFA 27(4)
[Fac. Fish., Hokkaido Univ., Hakodate 041, Japan]

82-002955 Pierce, R. B.; D. W. Coble and S. Corley. FISH CATCHES IN BAITED AND UNBAITED HOOP NETS IN THE UPPER MISSISSIPPI RIVER. *N. Am. J. Fish. Manage.* 1(2):204-206. 1981. SFA 27(4)
[Wis. Coop. Fish. Res. Unit, Univ. Wis., Stevens Point 54481]

82-002956 Prikhod'ko, B. I. SELECTIVE FISHING FOR THE CASPIAN "ANCHOV KILKA", *CLUPEONELLA ENGRAULIFORMIS*, USING ELECTRIC LIGHT. *J. Ichthyol (Engl. Transl. Vopr. Ikhtiol.)* 21(1):104-110. 1981. SFA 27(4)
[KaspNIRKh, Astrakhan, USSR]

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[Scripps Aquarium, La Jolla, CA 92093]

82-002962 Yamamoto, K. THE EFFECT OF THE DIFFERENCE BETWEEN THE TENSILE AND COMPRESSIVE PROPERTIES ON THE BENDING BEHAVIOUR OF NYLON MONOFILAMENTS. *Bull. Jpn. Soc. Sci. Fish.* 48(7):887-893. July 1982. SFA 27(4)
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FERTILIZATION OF SOIL AND WATER

82-002963 Langeland, A. THE LAKE LANGVATN FERTILIZATION EXPERIMENT: INTRODUCTION. *Holarctic Ecol.* 5(3):221-224. Sept. 1982. SFA 27(4)
[Univ. Trondheim Mus., N-7000 Trondheim, Norway] The limnology of Langvatn situated in Trøndelag county in Central Norway, has been studied for five years (1974-1978). In two years, 1975 and 1976, the lake was fertilized with a general fertilizer to change feeding conditions for the fish food organisms. Reasons for the choice of the lake are described together with a brief description of the lake itself, its catchment area, location, geological origin and the effect of human influence.

FISHWAYS, FISH PASSAGE THROUGH DAMS, ETC.

82-002964 Grabowski, S. J.; D. L. King and P. L. Johnson. DEVELOPMENT OF A FIXED HORIZONTAL SCREEN TO PREVENT TRANSBASIN FISH TRANSFER. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:170-194. 1982. Available @ $10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)
[1041 S. Harlan Way, Lakewood, CO 80226] An irrigation project is being constructed in North Dakota which will transport water from the Missouri River drainage to the Hudson Bay drainage. To prevent interbasin transport of undesirable fish, a fine mesh, fixed, horizontal screen is being developed. Laboratory tests were conducted to evaluate the filtration efficiency of the design using live or preserved fish eggs and larvae; to evaluate hydraulic features of the design, including development of sizing guidelines and optimization of self-cleaning features; and to assist in design and development of hardware features, spray cleaning, seal designs, and screen inspection and repair techniques. Operation- and mantenance-related problems are being evaluated at a field test facility. Items being considered at the field test facility include screen fouling and cleaning, screen wear, corrosion and materials selection, and debris types and quantities. Accessory equipment being evaluated includes traveling water screens, vibrating screens, automation devices, and debris handling systems. Maintenance requirements for the prototype structure are being formulated.

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MATHEMATICS, STATISTICAL METHODS, AND MODELING

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[Alaska Dep. Fish Game, Div. Commer. Fish., Kotzebue]

82-002968 Chadwick, E. M. P. STOCK-RECRUITMENT RELATIONSHIP FOR ATLANTIC SALMON (*SALMO SALAR*) IN NEWFOUNDLAND RIVERS. *Can. J. Fish. Aquatic Sci.* 39(11):1496-1501. Nov. 1982. In English with French summ. SFA 27(4)
[Fish. Res. Br., Dep. Fish. Oceans, P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

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82-002971 Fletcher, R. I. A CLASS OF NONLINEAR PRODUCTIVITY EQUATIONS FROM FISHERY SCIENCE AND A NEW FORMULATION. *Math. Biosci.* 61(2):279-293. Oct. 1982. SFA 27(4)
[Cent. Qual. Sci., Univ. Wash., Seattle 98195] Owing to the lack of sufficient parameters, certain nonlinear exploitation models of common usage in fisheries management are thought to be too inflexible to portray the productivities of fish stocks with sufficient fidelity. These models [typified by the formulaion of Schaefer, 1954] are statistically well behaved, however, since their governing equations all have fixed degrees of nonlinearity. Although one model of record [Pella and Tomlinson, 1969] offers an extra degree of parametric freedom not found in the aforementioned models, its productivity equation contains a variable exponent that introduces variable nonlinearity into the fitting procedure, which is an undesirable property that often leads to ill-determined parameter estimates. A new productivity formulation of fixed degree is developed here which exhibits the extra degree of parametric control not found in the Schaefer model but avoids the instabilities rising from variable exponents (as in the Pella-Tomlinson model) by having its parametric controls wholly contained by its coefficients. Some of the attributes and shortcomings of nonlinear single- and multiple-species models are also discussed.

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MATHEMATICS, STATISTICAL METHODS, AND MODELING (CONTINUED)

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[Kaliningrad Higher Inst. Mar. Eng., Kaliningrad, USSR]

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[Dep. Fish. Oceans, Fish. Res. Br., Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

LAKE MANAGEMENT AND RESEARCH

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[All-Union Res. Inst. Sea Fish. Oceanogr., Moscow, USSR]

82-002979 Mills, E. L. and A. Schiavone, Jr. EVALUATION OF FISH COMMUNITIES THROUGH ASSESSMENT OF ZOOPLANKTON POPULATIONS AND MEASURES OF LAKE PRODUCTIVITY. *N. Am. J. Fish. Manage.* 2(1):14-27. 1982. SFA 27(4)
[Dep. Nat. Resour., Cornell Univ., Ithaca, NY 14853]

82-002980 Roman, B. PAST AND PRESENT STATUS OF THE LAKE DESMET SPAWNING OPERATION. *Proc. Annu. Meet. Colo.-Wyo. Chap. Am. Fish. Soc.* 17:117-119. 1982. Available @$10.00 from Mary McAfee, Colo. Div. Wildl., 711 Independent, Grand Junction, CO 81501. SFA 27(4)
[Wyo. Game Fish Dep., P.O. Box 279, Story 82842]

82-002981 Rosko, J. J. THE POPULATION DYNAMICS AND MANAGEMENT OF THE LARGEMOUTH BASS, *MICROPTERUS SALMOIDES* (LACEPEDE) AND THE REDBREAST SUNFISH, *LEPOMIS AURITUS* (LINNAEUS) IN CALDER LAKE, NY. *Ph.D. dissertation, Fordham Univ.* 185p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(1):36. July 1982. SFA 27(4)

Abundance, biomass, growth, reproduction and mortality were estimated for

LAKE MANAGEMENT AND RESEARCH (CONTINUED)

82-002981 CONTINUED largemouth bass, *Micropterus salmoides* (Lacépède) and redbreast sunfish *Lepomis auritus* (Linnaeus) in Calder Lake, N.Y. in the summers of 1978 and 1979. The population of each species was broken down into two groups: Young of the Year and 1^+ and older fish. 1^+ and older bass and sunfish were caught by angling and tagged with small plastic bags. Abundance was estimated by a continuous mark-recapture technique. Young of the Year bass and sunfish were caught by electroshocking and marked by clipping one pelvic fin. A single census mark-recapture technique was used to estimate the abundance of Young of the Year fishes. Weight and length of each fish were recorded and a scale sample was taken from each fish. The population of largemouth bass in 1978 had an abundant 3^+ age-class while the redbreast sunfish had a smoothly descending age-class structure from the 1^+ to older sunfish, suggesting a relatively constant mortality rate year to year. Growth of bass was low compared to growth of other bass populations while growth of the redbreast sunfish was high compared to redbreast populations in the northeastern U.S. In 1979 the abundance and biomass of the bass population decreased about 40% from the previous year but the sunfish population remained about the same. This suggests that stocking programs in the northeastern U.S. might use the combination of largemouth bass and redbreast sunfish to reduce the chance of sunfish overpopulation--a common problem in largemouth bass-bluegill (*L. macrochirus*) communities. Compared to other U.S. populations reproduction of largemouth bass in Calder Lake was low and mortality was high while reproduction and mortality of redbreast sunfish were both low. Data on the population dynamics were integrated into hypothetical models for each species to estimate the biomass of bass and sunfish which could be removed each year on a sustained basis from Calder Lake. Important results include the accumulation of baseline data from a lake which had not been managed, the formulation of a management program for Calder Lake and the possibility of limiting sunfish overpopulation by a combination of largemouth bass and redbreast sunfish.

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[U.S. FWS, Great Lakes Fish. Lab., Sandusky Bay Stn., Sandusky, OH 44870]

RIVER AND STREAM MANAGEMENT AND RESEARCH

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[Dep. Fish. Oceans, Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

82-002985 Hauer, F. R. and J. A. Stanford. ECOLOGICAL RESPONSES OF HYDROPSYCHID CADDISFLIES TO STREAM REGULATION. *Can. J. Fish. Aquatic Sci.* 39(9):1235-1242. Sept. 1982. In English with French summ. SFA 27(4)
[Univ. Mont. Biol. Stn. East Shore, Bigfork, MT 59911]

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2-002987 Hesse, L. W.; G. L. Hergenrader; H. S. Lewis; S. D. Reetz and A. . Schlesinger, (eds.). THE MIDDLE MISSOURI RIVER. *Mo. River Study Group, orfolk, Nebr.* 301p. 1982. SFA 27(4)
[P.O. Box 934, Norfolk, NE 68701]

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[U.S. Bur. Land Manage., Salmon, ID]

2-002990 Oswood, M. E. and W. E. Barber. ASSESSMENT OF FISH HABITAT IN TREAMS: GOALS, CONSTRAINTS, AND A NEW TECHNIQUE. *Fisheries (Bull. Am. ish. Soc.)* 7(4):8-11. July-Aug. 1982. SFA 27(4)
[Wildl. Fish. Prog., Div. Life Sci., Univ. Alaska, Fairbanks 99701]
esolution of conflicts between forestry and fisheries requires assessment f stream habitat quality so that stream reaches of vulnerable or critical abitat may be avoided or protected. Assessment of stream habitats otentially involves a large number of stream features. Designers of stream urvey techniques must choose a subset of these features based on logistical onstraints of field work and intended use of the survey data. A new survey technique, developed for use in southeast Alaska, is described. The technique involves diagrammatic mapping of stream features, including water velocity/depth categories, spawning gravel, and several kinds of fish over.

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82-002992 Yant, P. R. HABITAT USE AND FEEDING ACTIVITY OF STREAM FISHES. *Ph.D. dissertation, Univ. Mich.* 133p. 1982. From Diss. Abstr. Int. B Sci. Eng. 43(2):334. Aug. 1982. SFA 27(4)

FARM POND AND SMALL IMPOUNDMENT MANAGEMENT AND RESEARCH

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[Kans. Fish Game Comm., 808 Highway 56, Dodge City 67801]

82-002994 Gabelhouse, G. D., Jr.; R. L. Hager and H. E. Klaassen. PRODUCING FISH AND WILDLIFE FROM KANSAS PONDS. *Kans. Fish Game Comm.* iii + 56p. Jan. 1982. Available from Kans. Fish Game Comm., R.R. 2, Box 54-A, Pratt 67124. SFA 27(4)

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[Ill. Power Co., Clinton Power Stn., East Rt. 54, Box 678, Clinton, 61727]

82-002996 Nesler, T. P. STUDIES OF THE LIMNOLOGY, FISH POPULATIONS, AN FISHERY OF TURQUOISE LAKE, COLORADO - 1979-80. *U.S. Dep. Interior Bur Reclam.* REC-ERC-82-5. vii + 31p. July 1981. SFA 27(4)
[Colo. Div. Wildl., 317 W. Prospect, Fort Collins 80526] Turquoise Lake i a dimictic, cold-water reservoir that is well oxygenated, relativel unbuffered, and slightly acidic. Turquoise Lake may be classified a oligotrophic on the basis of total dissolved solids, algal nutrients (N-P) and chlorophyll concentrations. Some oxygen depletion in the reservoir' hypolimnion occurs regularly in late summer and late winter though seasona turnover and perhaps the outlet at the reservoir bottom prevents anoxi conditions from developing. Turquoise Lake is limnologically similar t Twin Lakes in most aspects. Colder water temperatures and the introducti of *Tabellaria* and *Daphnia* in Turquoise Lake may have a noticeable impac upon the limnological character of Twin Lakes. The fishery at Turquoise Lak is based on the stocked, creel-sized rainbow trout. Though similar to Twi Lakes, a better catch rate for a similar fisherman effort and stocking rat exists. The stocked rainbow trout return in the harvest at a relatively lo level in one summer season but continue to contribute to the fishery in th following season. Fall stocking of creel-sized rainbow trout also appear to be quite effective in providing good catch rates in the following spring Catch rates have remained relatively high despite increased fisherme effort and similar levels of rainbow trout stocking between 1972-73 an 1980. In contrast to Twin Lakes, this may be a result of significan contributions to the fishery from a previous year's stock of fish, fal stocking and the absence of a significant population of lake trout. Lak trout have been unable to establish a self-sustaining population in th reservoir. Recruitment to a size capable of creating a fishery similar t Twin Lakes and providing a predatory balance for the sucker populations ar negligible. Periodic stocking appears necessary to maintain a lake trou population in the reservoir. Turquoise Lake demonstrates potential for kokanee salmon fishery and egg source. Natural reproduction occurs in th reservoir but water imports through the Homestake Tunnel during the fall winter period are necessary for spawning runs to occur in Lake Fork Creek.

82-002997 Shelley, J. J. and T. Modde. FIRST-YEAR GROWTH AND SURVIVAL O BLUEGILL AND BLACK BULLHEAD STOCKED WITH LARGEMOUTH BASS IN SOUTH DAKOT PONDS. *Prog. Fish-Cult.* 44(3):158-160. July 1982. SFA 27(4)
[1241 Bellaire St., Broomfield, CO 80020]

LARGE IMPOUNDMENT MANAGEMENT AND RESEARCH

82-002998 Axon, J. R. DEVELOPMENT OF A MUSKELLUNGE FISHERY AT CAVE RU LAKE, KENTUCKY, 1974-1979. *N. Am. J. Fish. Manage.* 1(2):134-143. 1981. SF 27(4)
[Ky. Dep. Fish Wildl. Resour., Frankfort 40601]

82-002999 Grimard, Y. and H. G. Jones. TROPHIC UPSURGE IN NEW RESERVOIRS A MODEL FOR TOTAL PHOSPHORUS CONCENTRATIONS. *Can. J. Fish. Aquatic Sci* 39(11):1473-1483. Nov. 1982. In English with French summ. SFA 27(4)

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82-002999 CONTINUED
[Serv. Qual. des eaux, Environ. Que., 2360, Chemin Sainte-Foy, Sainte-Foy, PQ G1V 4H2, Canada]

82-003000 Jones, A. R. THE "TWO-STORY" RAINBOW TROUT FISHERY AT LAUREL RIVER LAKE, KENTUCKY. *N. Am. J. Fish. Manage.* 2(2):132-137. 1982. SFA 27(4)
[Ky. Dep. Fish Wildl. Resour., Frankfort 40601]

ESTUARY MANAGEMENT AND RESEARCH

82-003001 Ashe, D. M. FISH AND WILDLIFE MITIGATION: DESCRIPTION AND ANALYSIS OF ESTUARINE APPLICATIONS. *Coastal Zone Manage. J.* 10(1-2):1-52. 1982. SFA 27(4)

82-003002 Benson, N. G., (ed.). LIFE HISTORY REQUIREMENTS OF SELECTED FINFISH AND SHELLFISH IN MISSISSIPPI SOUND AND ADJACENT AREAS. *U.S. Fish Wildl. Serv.* FWS/OBS-81/51. 104p. Mar. 1982. Available @ $12.00 (paper) or $4.00 (microfiche) as order no. PB82-230699 from NTIS, 5285 Port Royal Rd., Springfield, VA 22161]

The published and unpublished literature on spawning, nursery, and migratory requirements of 41 finfish and shellfish species in Mississippi Sound, Mobile Bay, and adjacent waters was synthesized to assist the U.S. Army Corps of Engineers in planning dredging activities for navigation. Species were selected because of high abundance or significant value for recreational or commercial fishing. The primary ecological parameters considered were temperature, salinity, depth, substrate, turbidity, and current. Available data on habitats used by season and for spawning, nursery, or migration purposes are summarized. Food habits, distribution in water column (pelagic, demersal), and diurnal behavior are treated. The ecological role of each species in the ecosystem is discussed. Important sport and commercial species included were gulf menhaden, blue crab, spotted seatrout, Atlantic croaker, red drum, sand seatrout, spot, king mackerel, Spanish mackerel, and brown, white, and pink shrimp.

82-003003 Gilmore, R. G.; D. W. Cooke and C. J. Donohoe. A COMPARISON OF THE FISH POPULATIONS AND HABITAT IN OPEN AND CLOSED SALT MARSH IMPOUNDMENTS IN EAST-CENTRAL FLORIDA. *Northeast Gulf Sci.* 5(2):25-37. July 1982. SFA 27(4)
[Harbor Branch Found., Inc., R.R. 1, Box 196, Fort Pierce, FL 33450]

82-003004 Marais, J. F. K. THE EFFECTS OF RIVER FLOODING ON THE FISH POPULATIONS OF TWO EASTERN CAPE ESTUARIES. *S. Afr. J. Zool.* 17(3):96-104. 1982. In English with Afrikaans summ. SFA 27(4)
[Dep. Zool., Univ. Port Elizabeth, Port Elizabeth, South Africa] The effect of river flooding during July and August 1979 on fish populations in two eastern Cape estuaries is compared. It is shown that floods of varying intensity occur regularly in these estuaries. Fish populations in the two estuaries, namely the Swartkops and the Sundays, were differently affected: members of the family Mugilidae increased in numbers in the Swartkops estuary after the floods but decreased to insignificant numbers in catches in the Sundays estuary for a number of months after the floods. It is postulated that mud and silt which are deposited in the Swartkops during the flood serve

ESTUARY MANAGEMENT AND RESEARCH (CONTINUED)

82-003004 CONTINUED as a food source for the mullet whereas the rich surface benthos layer of a channel-like estuary like the Sundays is washed away by heavy floods.

82-003005 Weinstein, M. P. COMMENTARY: A NEED FOR MORE EXPERIMENTAL WORK IN ESTUARINE FISHES ECOLOGY. *Northeast Gulf Sci.* 5(2):59-64. July 1982. SFA 27(4)
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[Cent. Cienc. Mar. Limnol., Univ. Nac. Auton. Mex., Cuidad Univ., Mexico 20, D.F.]

82-003007 Yáñez-Arancibia, L. A. SOBRE LOS ESTUDIOS DE PECES EN LAS LAGUNAS COSTERAS: NOTA CIENTÍFICA. [ON THE STUDIES OF FISHES IN COASTAL LAGOONS: SCIENTIFIC NOTE.] *An. Cent. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex.* 2(1):53-60. 1975. In Spanish with English summ. SFA 27(4)
[Cent. Cienc. Mar. Limnol., Univ. Nac. Auton. Mex., Cuidad Univ., Mexico 20, D.F.]

MARINE MANAGEMENT AND RESEARCH

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[Pac. Environ. Group, Southwest Fish. Cent., NOAA, Monterey, CA 93940]

82-003009 Chhaya, N. D.; A. U. Buch and K. R. Narayanan. OBSERVATIONS ON THE FISHERIES OF MULLET AND SCOPE FOR ITS CULTURE IN GULF OF KUTCH. *Indian J. Fish.* 26(1-2):47-51. 1979. SFA 27(4)
[Mar. Biol. Res. Stn., Port Okha, India]

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    82-001087
  Tylodelphys clavata
    82-001083
  Ulcerative Dermal Necrosis
    82-001780
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    82-001845
    82-002721
  Unicapsula seriolae
    82-002741
  Urocleidus adspectus
    82-000382
    82-000383
  Uvulifer amblopliti s
    82-001076
  Vibrio anguillarum
    82-000369
    82-001792
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    82-001795
    82-001797

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- Vibrio anguillarum
  - 82-002721
- Vibriosis
  - 82-000364
  - 82-001044
  - 82-001046
  - 82-001792
  - 82-001795
  - 82-001801
  - 82-002726
- Viral Diseases
  - 82-001057
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  - 82-002749
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  - 82-001058
  - 82-001828
  - 82-001834
  - 82-001837
  - 82-002743
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  - 82-001072
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  - 82-001820
- X-cells
  - 82-002765
  - 82-002775
- Yersinia ruckeri
  - 82-001793
  - 82-001794
  - 82-001796
  - 82-001800
  - 82-001803

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Parasites/Diseases
- Yersinia ruckeri
  - 82-002734
- Zschokkella
  - 82-002740

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- Acoustico-Lateralis System
  - 82-000642
  - 82-000797
- Adrenalin
  - 82-001476
- Air Breathing
  - 82-000100
  - 82-000116
  - 82-000136
  - 82-000671
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  - 82-001447
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- Alcohol Dehydrogenase
  - 82-000101
- Amino Acids
  - 82-000037
  - 82-000083
  - 82-000130
  - 82-000156
  - 82-000157
  - 82-001487
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  - 82-002245
  - 82-002371
- Anoxia
  - 82-000147
  - 82-001513
  - 82-002267
  - 82-002359
- Antifreeze Production
  - 82-000106
  - 82-000667
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  - 82-002262
  - 82-002333
- Antigens
  - 82-000144
- Ascorbic Acid
  - 82-000145
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  - 82-001933
  - 82-002097
- ATP
  - 82-000635
  - 82-000662
  - 82-000687

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  - ATP
    - 82-001421
    - 82-001516
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    - 82-000666
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    - 82-000087
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    - 82-002268
    - 82-002271
    - 82-002287
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    - 82-002344
    - 82-002360
    - 82-002796
  - Bioenergetics
    - 82-000124
    - 82-000673
    - 82-000694
    - 82-001441
    - 82-002216
    - 82-002295
    - 82-002316
    - 82-002351
  - Blood Chemistry
    - 82-000085
    - 82-000098
    - 82-000100
    - 82-000112
    - 82-000114
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  - Blood Chemistry
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    - 82-002366
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    - 82-002848
  - Cadmium
    - 82-000430
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    - 82-000742
    - 82-001895
    - 82-001896
    - 82-002368
  - Carbon
    - 82-002272
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    - 82-000656
    - 82-000657
    - 82-000718

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    82-001512
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    82-000035
    82-000128
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    82-002314
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    82-000656
    82-000720
    82-002366
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    82-001390
    82-001457
  Collagen
    82-002294
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  Corpuscle of Stannius
    82-001471
  Corticosteroids
    82-000736
  Cortisol
    82-001493
    82-002300
    82-002353
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    82-000645
    82-000664
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    82-000688
    82-001453
    82-001478
    82-001648
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    82-000117
    82-000129
    82-000151
    82-000645
    82-000670
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    82-000703
    82-000714
    82-000732
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    82-000759
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    82-001426
    82-001451

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    82-001482
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Physiology
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    82-001871
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    82-001450
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    82-000115
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    82-002206
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    82-000111
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    82-000139
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    82-002360
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Physiology
  Lipid Metabolism
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    82-002247
  Liver
    82-000152
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    82-001517
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    82-001496
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  Metallothionein
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    82-000087

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  Nervous System
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    82-000110
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Physiology
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    82-002291
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    82-001456
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    82-000707
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  - Acid Mine Water
    - 82-001096
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    - 82-002794
    - 82-002811
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    - 82-000394
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  - Biomagnification
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    - 82-001097
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    - 82-002793
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